

12/14/29

# POPULAR SCIENCE

MONTHLY

15¢

JAN.

*Three magazines in one*  
AUTOMOBILES • HOME & SHOP • MECHANICS



Bombers Swarm for Defense ★ PAGE 73



# The Guide to Better Value in '41



- 1 Advanced streamlining on longer, lower, wider body.
- 2 More spacious interior with wider front seat.
- 3 Concealed running boards and door hinges.
- 4 Doors hinged at the front for greater safety.
- 5 Streamlined door handles harmonize with exterior.
- 6 Dome light operates automatically as well as manually.
- 7 Wider door entrances.
- 8 Door swing-stops hold doors open for more convenient entrance and exit.
- 9 New flowback slant to windshield.
- 10 New double-curved back window.
- 11 Wider steel floor further strengthens Unisteel structure.
- 12 New steel reinforcements front and rear.

**T**HERE'S no doubt that the 1941 Unisteel Turret Top Body by Fisher does more this year than ever before to set the new General Motors cars apart from the rest. Here Fisher craftsmen have truly scored one of automotive history's greatest achievements—by dressing a more spacious interior in the sleekest, fleetest lines a Body by Fisher ever had. Above and below you see the brilliant result as adapted to the new 1941 Chevrolet. And on the right are a few of the major new features this new Body by Fisher brings to 1941 General Motors cars in every price class. No wonder they're saying, "Body by Fisher is '41's guide to better value."

You'll say "CHEVROLET'S FIRST BECAUSE IT'S FINEST!"—and you'll see one reason why in the breath-taking new Body by Fisher on the 1941 Chevrolet Special De Luxe Sport Sedan. It's a longer, lower, wider Unisteel Turret Top Body by Fisher than Chevrolet has ever had.



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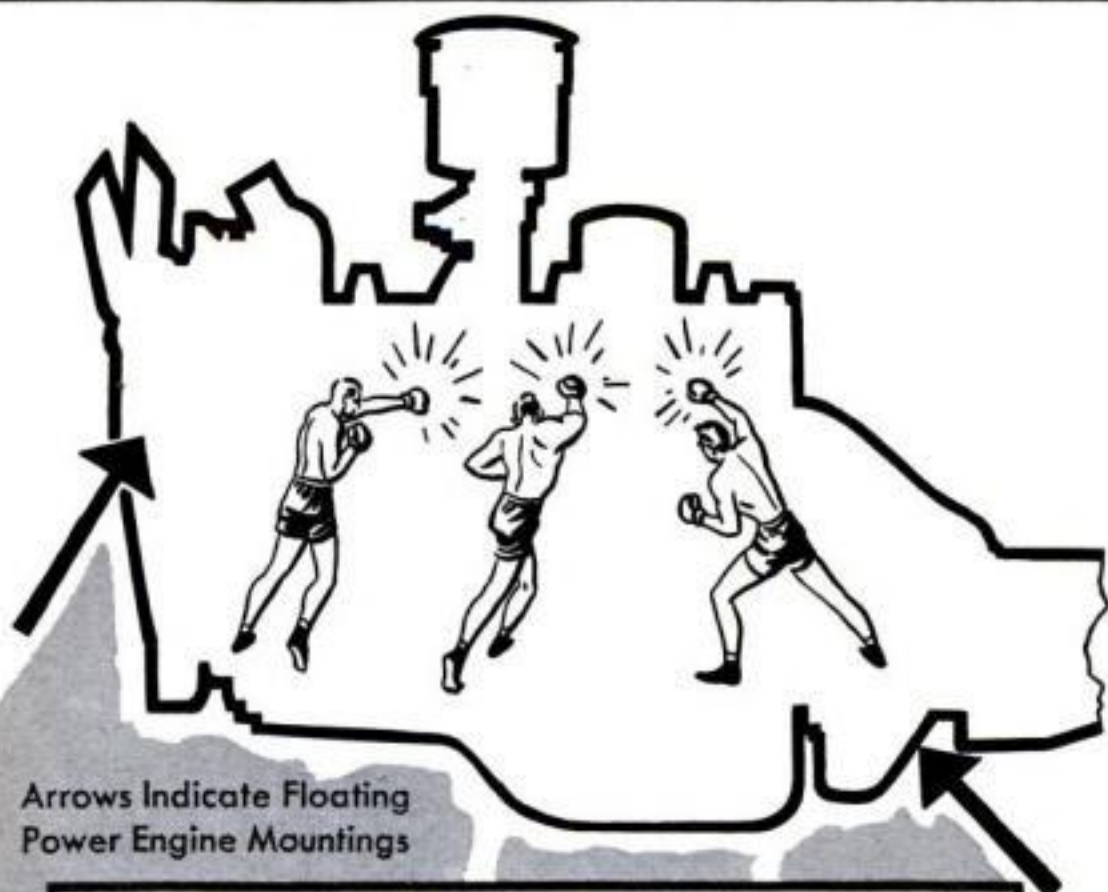
*Fisher*

ON GENERAL MOTORS CARS ONLY:

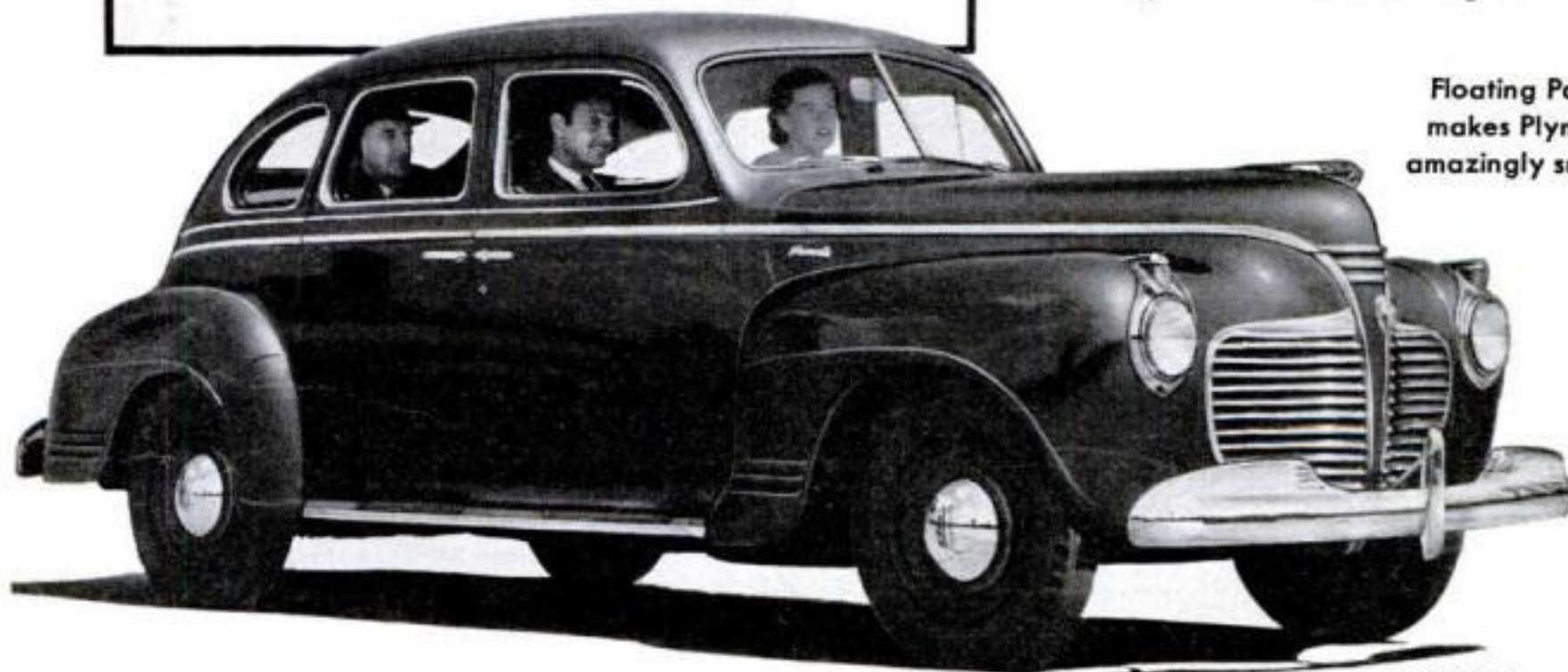
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## Why a FLOATING POWER ENGINE CAN "RIDE THE PUNCHES"



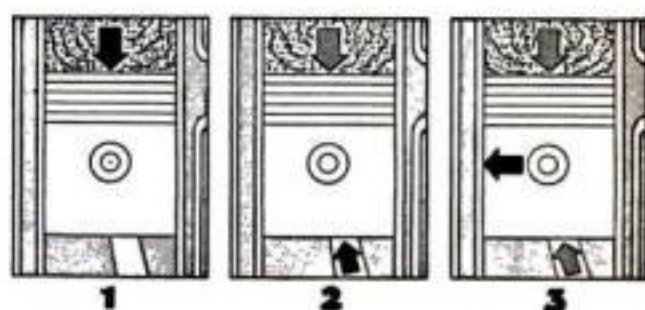
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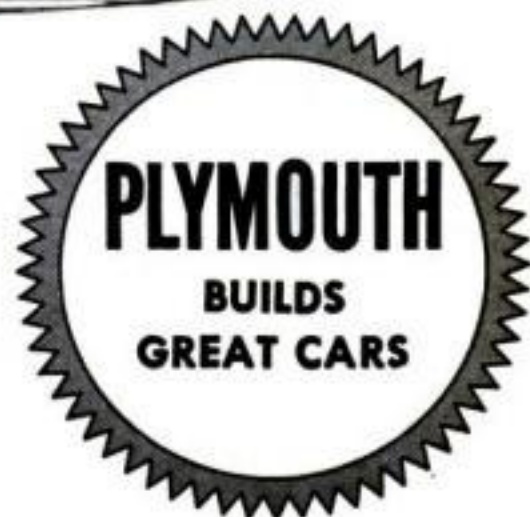
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# POPULAR SCIENCE

FOUNDED 1872

MONTHLY

VOL. 138 NO. 1

Mechanics & Handicraft

THE NEWS PICTURE MAGAZINE OF SCIENCE AND INDUSTRY

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RALPH MORSE, 23-year-old camera veteran who made the pictures of army life on pages 47 to 53, snaps a whole series of photographs in the time it takes the average man to get focused. Hops a plane at the drop of a hat, and has photographed such famous people as President Roosevelt and the Duke and Duchess of Windsor. His chief interest, after film and flying, is good food.

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Published monthly at 353 Fourth Avenue, New York, N. Y., by Popular Science Publishing Co., Inc. Godfrey Hammond, President and Treasurer; R. C. Wilson, Raymond J. Brown, Vice Presidents; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright, 1940, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and the Pan American Copyright Convention. Single copy, 15 cents; Canada, 20 cents. Yearly subscriptions to United States and its possessions, \$1.50; Canada, \$2.00; foreign countries, excepting Canada, \$2.50. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address.



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**I**F you are normal, you want the comforts and luxuries which are the by-products of success—a home of your own—a new car—the leisure to read—the means to travel.

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nevertheless prefer to think that there's "nothing in it." That's the excuse they make for their futures.

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## Coming Next Month—

ERIC SCHAAAL, well-known photographer, and Hickman Powell, ace reporter, have joined forces to bring POPULAR SCIENCE readers the latest news in the glue industry. In "Plastic Glue for Everybody," they tell the dramatic story of a brand-new development from the synthetic chemist's laboratory—a development that now places at the disposal of the home owner and the home craftsman a revolutionary glue formerly available only to manufacturers.

FAST FREIGHTS OF THE HIGHWAY cover American roads today, carrying cargoes over a new transportation network that spreads from coast to coast. To get the inside story of the men who drive these giant trucks, we put Ralph Morse and his faithful camera into the cab of a 20-ton tractor-trailer unit for a night trip from New York to Baltimore. In a seven-page picture story, "Big Wheels Rolling," he takes you for a truck ride you'll never forget.

ONCE IN A LIFETIME of driving, the average motorist might find himself in the sort of driving predicament Jimmie Lynch's Death Drivers put themselves into a dozen times a day. Yet Jimmie and other stunt drivers lead notoriously safe lives. Because they do, we asked Jimmie to tell you what to do to recover control of your car when that once-in-a-lifetime close call does occur. Look for his answers next month in "Jimmie Lynch Gives Seven Rules for Safety."

ONLY A FEW YEARS AGO, Dmitri Kessel didn't know any more about taking pictures than the average man, but he thought photography might be an interesting and remunerative line of work. So, as his first step, he took a course in the best photographic school he could find. From that time on, he has gone straight up until now he is one of the top-ranking industrial photographers. His success story is told by John H. Walker, city editor of the New York newspaper PM, in an article, "Dramatizing Industrial Photography."

FIREPLACES are often cranky affairs that give out much smoke and little heat, but most of them can be made to burn properly. What tests to make, how to remedy any defects, the right way to build a fire, and scores of hints are contained in an article, "Fireplace Doctor Tells How to Cure Chimney Ills." It is based upon the experience of Frederic N. Whitley, of Brooklyn, N. Y., whose family has specialized in fireplaces for four generations.



# what will you be doing



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| <input type="checkbox"/> Architectural Drafting   |                                       | <input type="checkbox"/> Electrical Drafting      | <input type="checkbox"/> Mechanical Drafting      | <input type="checkbox"/> Refrigeration             |
| <input type="checkbox"/> Architecture             |                                       | <input type="checkbox"/> Electrical Engineering   | <input type="checkbox"/> Mechanical Engineering   | <input type="checkbox"/> Sanitary Engineering      |
| <input type="checkbox"/> Auto Engine Tune-up      |                                       | <input type="checkbox"/> Electric Lighting        | <input type="checkbox"/> Mine Foreman             | <input type="checkbox"/> Sheet Metal Work          |
| <input type="checkbox"/> Auto Technician          |                                       | <input type="checkbox"/> Fire Bosses              | <input type="checkbox"/> Navigation               | <input type="checkbox"/> Steam Electric            |
| <input type="checkbox"/> Aviation                 | <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Foundry Work             | <input type="checkbox"/> Patternmaking            | <input type="checkbox"/> Steam Engines             |
| <input type="checkbox"/> Bridge Engineering       |                                       | <input type="checkbox"/> Fruit Growing            | <input type="checkbox"/> Pharmacy                 | <input type="checkbox"/> Steam Fitting             |
| <input type="checkbox"/> Building Estimating      |                                       | <input type="checkbox"/> Heating                  | <input type="checkbox"/> Plumbing                 | <input type="checkbox"/> Structural Drafting       |
| <input type="checkbox"/> Chemistry                |                                       | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Poultry Farming          | <input type="checkbox"/> Structural Engineering    |
| <input type="checkbox"/> Civil Engineering        |                                       | <input type="checkbox"/> Highway Engineering      | <input type="checkbox"/> Practical Telephony      | <input type="checkbox"/> Surveying and Mapping     |
| <input type="checkbox"/> Coal Mining              |                                       | <input type="checkbox"/> House Planning           | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Telegraph Engineering     |
| <input type="checkbox"/> Concrete Engineering     |                                       | <input type="checkbox"/> Locomotive Engineer      | <input type="checkbox"/> Radio, General           | <input type="checkbox"/> Textile Designing         |
| <input type="checkbox"/> Contracting and Building |                                       | <input type="checkbox"/> Machinist                | <input type="checkbox"/> Radio Operating          | <input type="checkbox"/> Toolmaking                |
|   |                                       | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> Radio Servicing          | <input type="checkbox"/> Welding, Electric and Gas |
|   |                                       |   |   | <input type="checkbox"/> Woolen Manufacturing      |

### BUSINESS COURSES

- |  |  |  |   |   |
|--|--|--|---|---|
| <input type="checkbox"/> Accounting              | <input type="checkbox"/> Advertising   | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Foremanship          | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> Bookkeeping             |  | <input type="checkbox"/> Commercial          | <input type="checkbox"/> French               | <input type="checkbox"/> Salesmanship         |
| <input type="checkbox"/> Business Correspondence |  | <input type="checkbox"/> Cost Accounting     | <input type="checkbox"/> Grade School         | <input type="checkbox"/> Secretarial          |
| <input type="checkbox"/> Business Management     |  | <input type="checkbox"/> C. P. Accounting    | <input type="checkbox"/> High School          | <input type="checkbox"/> Sign Lettering       |
| <input type="checkbox"/> Cartooning              | <input type="checkbox"/> Civil Service | <input type="checkbox"/> First Year College  | <input type="checkbox"/> Lettering Show Cards | <input type="checkbox"/> Spanish              |
|  |  |  | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Traffic Management   |

### HOME ECONOMICS COURSES

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Home Dressmaking                       | <input type="checkbox"/> Tea Room and Cafeteria |
| <input type="checkbox"/> Foods and Cookery    | <input type="checkbox"/> Professional Dressmaking and Designing | <input type="checkbox"/> Management, Catering   |

Name..... Age..... Address.....

City..... State..... Present Position.....

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*From the  
News Editor's  
Desk*

**N**ONSHRINKABLE WOOL may soon become more than a housewives' dream. Two years of research in treating wool yarn with a bromine process have convinced the Warner Chemical Co., of New York, that it has found a method of preventing shrinking which does not affect the wool's warmth, softness, or dyeability. The process involves no change in textile manufacturing methods, and adds only five percent to the cost of a finished article. A treated pair of wool socks, used for eighteen months in a hospital, have been washed almost every week and haven't shrunk yet.

**W**IND-DRIVEN GENERATORS with giant vanes like airplane wings will be installed next spring in an experimental 1,000-kilowatt vento-electric station in the Green Mountains near Rutland, Vt. Using a Smith-Putnam wind turbine developed by the S. Morgan Smith Company, of York, Pa., the station is expected to produce power as cheaply as any method now available. Accurate speed regulation of the generators has been a major problem in this form of power production in the past, but engineers believe they have solved it at last. Installations of this type would be used with other sources of power, such as hydroelectric plants, which could take over the load in periods of calm.

**E**LECTRIC POWER WAS TRANSMITTED by wireless in a recent demonstration at the Westinghouse Lamp Research Laboratories, Bloomfield, N. J. Flash-light bulbs with copper antennae were lighted by high-frequency waves from a new type of generator, a "Klystron," several yards away. The generator and its uses are still experimental.

**M**ILKY DISEASE," a bacteria with which Japanese-beetle grubs sow the seeds of their own destruction, is being tested by scientists at the Department of Agriculture's research station at Moorestown, N. J., as a new means of combating the beetles. Grubs infected with the bacteria turn milky white and disintegrate, leaving only a tiny heap of germs, which are picked up by the next grubs to come along. Birds help in distributing the bacteria by carrying infected grubs from one area to another. The disease does not affect birds, animals, human beings, or plant life.

**L**ARGE AMOUNTS OF VITAMIN D and calcium given to patients with broken bones, in accordance with current practice, may actually retard or prevent healing. Dr. Edward L. Compere, of Chicago, reported to the American College of Surgeons recently that experiments with rats indicated that patients with broken bones would recover more quickly if fed only an adequate diet. This rule does not apply to infants, Dr. Compere said, because children require extra Vitamin D and calcium to prevent rickets. Older children and adults can get all the Vitamin D they need from their diets, he said.



**YES-** I'M CONVINCED THAT I CAN MAKE GOOD MONEY IN RADIO. I'M GOING TO START TRAINING FOR RADIO RIGHT NOW.



**NO-** NOT ME. I'M NOT GOING TO WASTE MY TIME. SUCCESS IS JUST A MATTER OF LUCK AND I WASN'T BORN LUCKY.

**BILL SAID "YES"**  
HE'S MAKING GOOD MONEY IN RADIO NOW



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I'VE BEEN STUDYING RADIO ONLY A FEW MONTHS AND I'M ALREADY MAKING GOOD MONEY IN MY SPARE TIME

THANKS



OH BILL! I'M SO PROUD OF YOU. YOU'VE GONE AHEAD SO FAST IN RADIO

YES! I'VE GOT A GOOD JOB NOW AND A REAL FUTURE. THANKS TO N.R.I. TRAINING

**TOM SAID "NO"**  
HE'S STILL WAITING FOR "LUCK"



BILL'S A SAP TO WASTE HIS TIME STUDYING RADIO AT HOME



SAME OLD GRIND -- SAME SKINNY PAY ENVELOPE -- I'M JUST WHERE I WAS FIVE YEARS AGO



GUESS I'M A FAILURE. LOOKS LIKE I'LL NEVER GET ANYWHERE

YOU'LL ALWAYS BE A FAILURE, TOM, UNLESS YOU DO SOMETHING ABOUT IT. WISHING AND WAITING WON'T GET YOU ANYWHERE



J. E. SMITH, President  
National Radio Institute  
Established 25 Years

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Dept. 1AP3  
National Radio Institute  
Washington, D. C.

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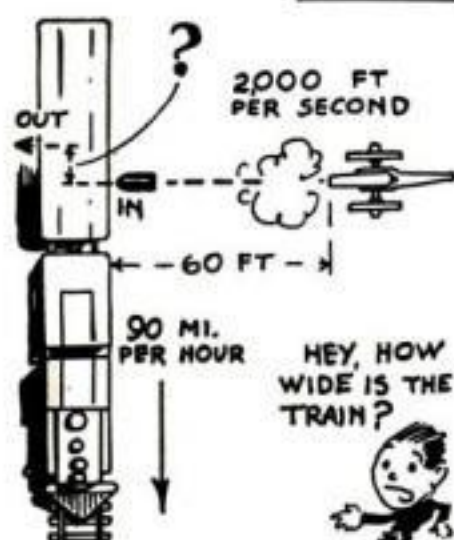
City..... State.....



# Readers Say:

## Cameraman Catches Kids Having Fun at the Zoo

YOUR readers may be interested to know that the youthful models who posed for the pictures in the "Mechanized Zoo" story (page 104) are my son, Peter William Morris, aged 2, and Joy Krumm, 4. Peter William began his photographic career by posing at the New York World's Fair with William Allen White, who called him "the most photogenic baby in the world." Peter William and Joy also posed for a picture series "Vest-Pocket Romance at the Fair."—W. M., Elmhurst, Long Island, N. Y.



## The Cannon-Ball Express

IF A cannon is fired at right angles to a train moving 90 m.p.h., from a distance of 60 feet, with the velocity of the projectile 2,000 feet per second, what will be the distance from the hole made in the near side of the train to the hole made in the far side?—H. H., New York City.

## A Stamp Licked Nicaragua's Canal

IN ANSWER to E. S. T., of Washington, D. C., who asks what became of the Nicaragua Canal: Before the Panama Canal was built, those who opposed the Nicaragua route said that the canal would be in constant danger of destruction by volcanic eruptions. When it came to a vote in Congress, a French engineer sent every member of the Senate a letter bearing a Nicaragua stamp which showed a smoking volcano. The Panama route was chosen by a margin of four votes. I am a stamp collector and would like a stamp department in P. S. M.—A. S. C., Uniontown, Ohio.

HOW MANY DAMAGING ERUPTIONS HAVE THERE BEEN SINCE?



## Mobilize the Home Workshops for National Defense!

IN THESE days when all the resources of our country are being mobilized for defense, have you thought of the possibilities in the home workshops? There are thousands of metal lathes that could be used as accurate production machines. Home-workshop groups could be assigned quantities of production parts to turn out. Surely some use should be made of this big child of American leisure.—R. H. B., Boothwyn, Pa.

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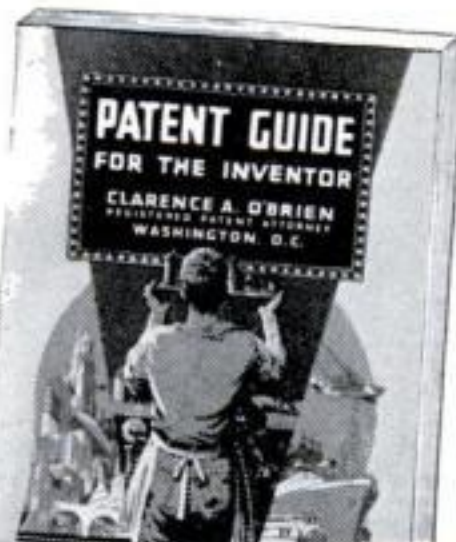
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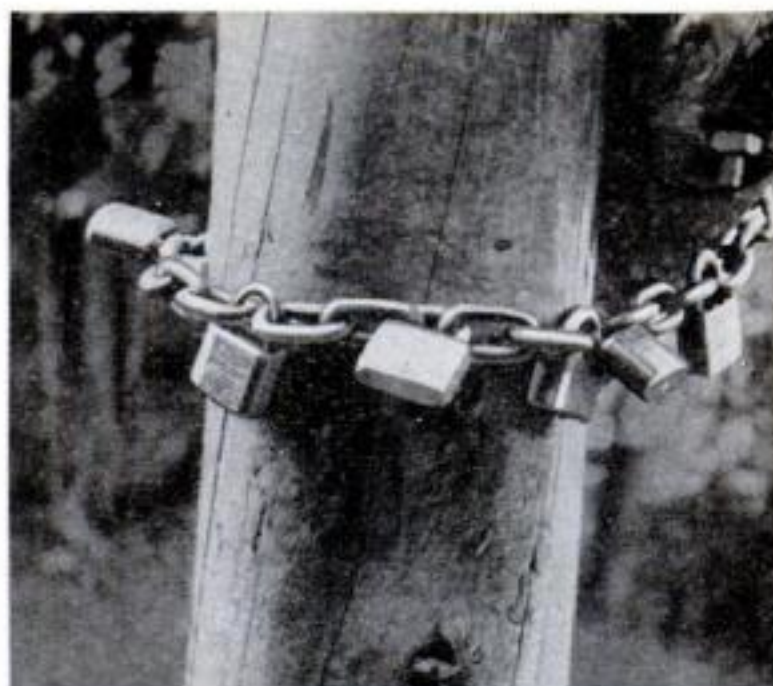
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BILL!



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IT COSTS me less than nothing to be a subscriber to Popular Science Monthly. I pay \$1.50 a year and get thousands of ideas in return, besides lots of interesting reading matter. You paid me, this last year, \$11 for two ideas. I hope to get more out of you this year.—W. P. S., Pasadena, Calif.



## Chain of Padlocks Tells Who Left the Gate Open

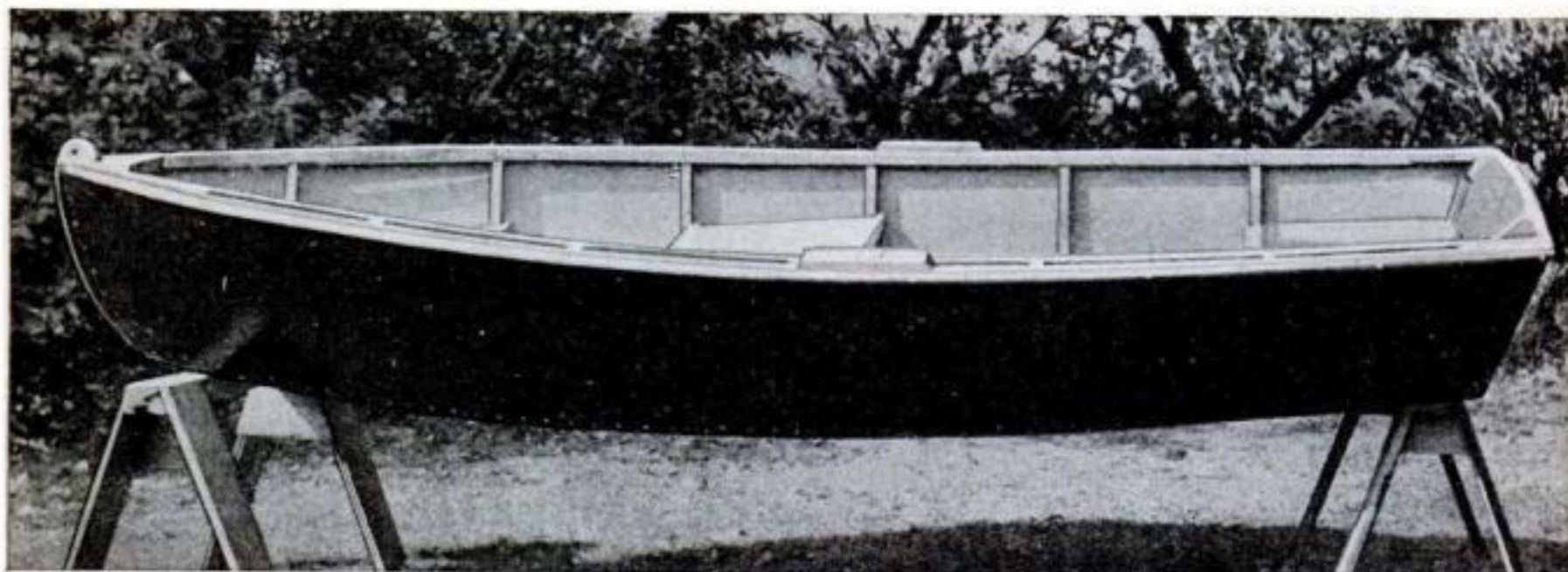
PEOPLE who leave locked gates open are a nuisance. An association owning hundreds of acres in the Adirondacks has found a way to control them. It owns a private log bridge across a lake, which is crossed by a public trail. Hikers are welcome, but the only cars permitted to cross the bridge are those of a few camp owners and the trucks of the fire wardens. Nine padlocks form links in the chain that closes the log gate. Each padlock has its own key, and each key its owner. If the gate is found open, the unlocked padlock will immediately identify the guilty non-closer.—D. V. A., Saratoga Springs, N. Y.

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HERE is a snap of the Plywood Dinghy described in your magazine. It weighs eighty pounds and cost \$19.95 to build, with a few screws, etc., left over. This is the second boat I have made from your plans, the first being the 17-foot Cabin Cruiser of plywood construction.

I would like to express my appreciation for the clearness of the plans and presentation.—E. C., Dorchester, Mass.

Good work on E. C.'s part, but he should have spent five cents more. Our cost estimate was \$20, not \$19.95!—Ed.







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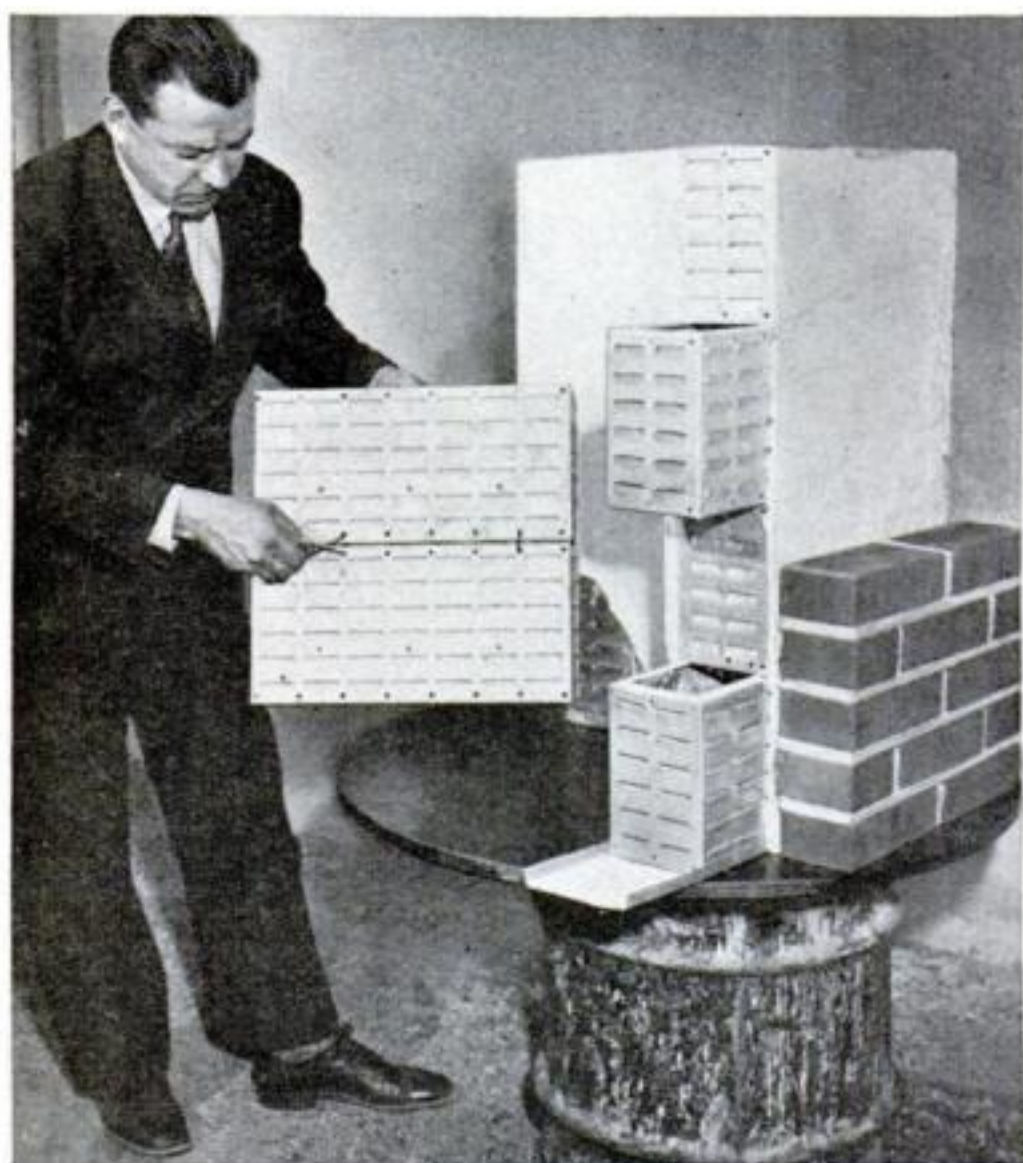
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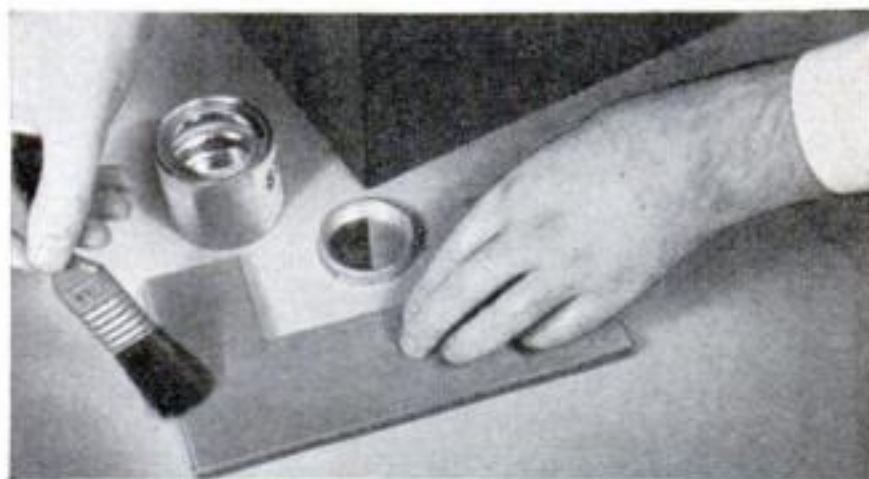
How metal blocks can be used with other building materials

## Metal Building Blocks Resist Fire, Vermin

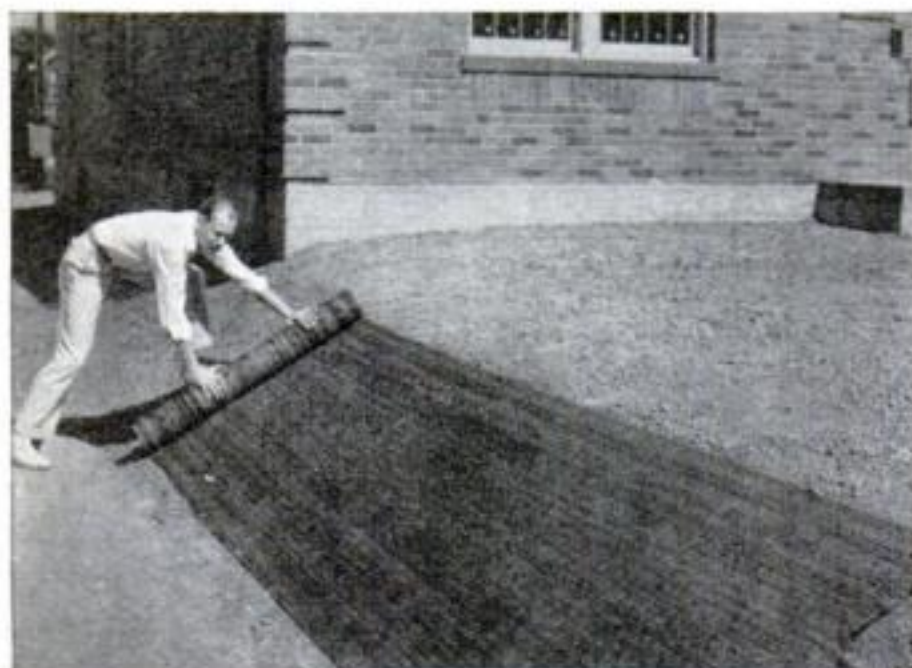
"BUILDING BLOCKS" stamped out of noncorrosive steel provide a speedy and economical way of constructing small dwellings, apartment houses, and office buildings alike. They weigh only two pounds apiece, compared to fifty pounds for concrete blocks of the same standard size, and are declared to eliminate waste of material. According to the maker, they are proof against fire and vermin. In using this method of construction, the metal units are stacked one on top of another, and permanently fixed in place with locks of spring wire. The illustration at left shows how they may be employed in conjunction with other building materials. For some purposes they may be used alone. Seven years' experience in tearing down houses and finding rotten studs and sills suggested the idea to the inventor, Augustus Frati.

## Special Glue Holds Anything—It's Weatherproof, Too

RESISTANT to weather and insoluble in water, a versatile glue of special composition may be applied to virtually any similar or dissimilar materials. Two pieces of wood glued together with it will never warp, it is said. The quick-drying adhesive may be used hot or cold, and a film of only tissue thickness is sufficient.



Spreading glue on wood. A tissue-thin film does it



Laid over seeded soil, twine mesh holds seed in place

## "Erosion Net" Keeps Seed from Washing off Lawn

HEAVY rains cannot wash away freshly planted grass seed from slopes protected with "erosion nets," successfully introduced last fall. Laid over the soil, a quarter-inch mesh of rot-resisting paper twine forms innumerable tiny dams, holding the seed in place without cutting off beneficial sunlight. When the grass reaches a height of two and a half inches, the net may be removed. Designed especially for lawns and terraces, it is an adaptation of an idea used by the U. S. Department of Agriculture.



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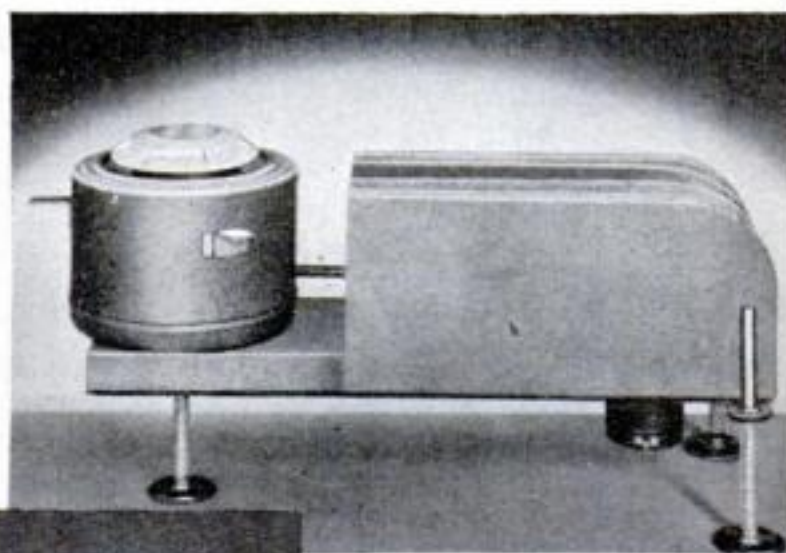
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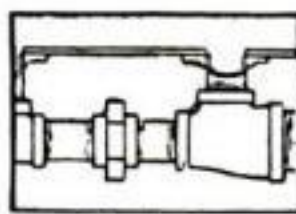
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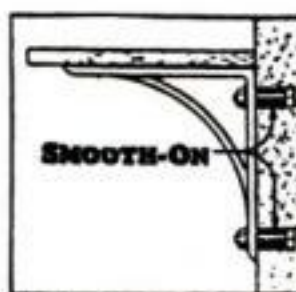
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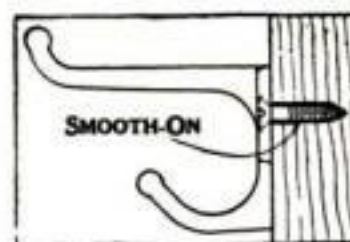
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# With the Inventors

JUST what a movie patron will see on the screen of a movie theater, when he goes in, may be learned from an indicator to be mounted near the ticket window. Thus he can avoid sitting through an unfinished part of a program, and enter at just the right time for the beginning of the feature, news-



reel, or comedy, as he prefers. In this scheme, invented by Arthur G. Gross, of Beverly Hills, Calif., a "clock" dial is divided into segments proportional to the relative time each program item consumes. A rotating pointer then indicates which is now showing, and when it will end. An electric clock drives the pointer, through adjustable gears that may be preset according to the total time of the complete showing. . . . THE U. S. PATENT OFFICE now grants more than 43,000 patents yearly . . . STRIKING MATCHES of the book type safely and effectively is the object of a cover designed by

Charles C. Baldwin, of St. Louis, Mo. Unfolded, two ranks of matches reveal striking surfaces just within each end of the base. When a match is detached, placed with the head inside the folder, and withdrawn under gentle pressure as shown in the illustration, the match lights up. Besides preventing accidental ignition of the



other matches, the idea has added advantages. Dampness does not reach the inside striking surface, to cause misfire; and the possibility of holding the match steady makes it easier to light a cigarette in the wind. . . . NO MATTER HOW MANY levers,

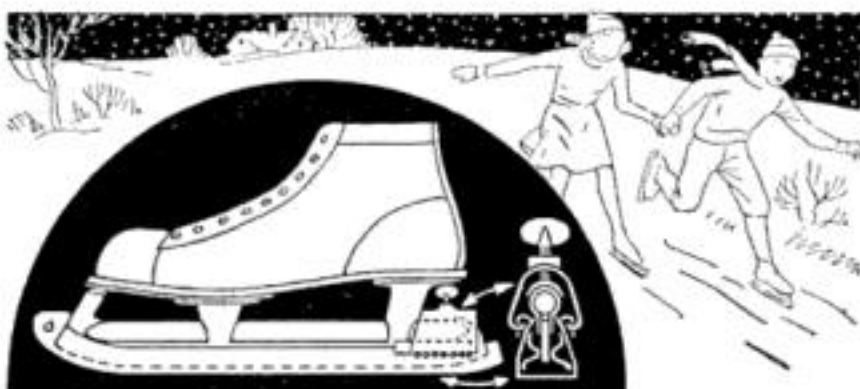
(Continued on page 22)

cams, and cogwheels an inventor's fancy may put together, he cannot patent his invention if it is useless. In some way—possibly as a toy, a turbine, or a tuba—it must serve a real need . . . Frederick B. Chapman, of Greenwich, Conn., has devised a way to keep ice or fruit from clogging the lip of a beverage glass.

His solution, an "ice-retaining guard," consists of a ring-shaped coil spring of nickel or stainless steel, to be inserted in a glass just before serving. Within reasonable limits the device will fit glassware of varying size and shape, and is held securely in place by rubber-lined hooks that will not chip the rim. If desired, colored or numbered



identifying symbols may be attached to the spring inserts, indicating whose glass is whose if they are refilled. . . . WOMEN INVENTORS account for one out of every seventy patents issued, and their proportion of the total is steadily growing . . . By converting standard ice skates for use on packed snow, Oscar Nygaard, of Saugus, Mass., hopes to make "snow skating" as popular as coasting or skiing. He proposes detachable, auxiliary skate runners with wide bases, grooved lengthwise to prevent skidding. By means of thumbscrews they could quickly be fitted to any type of ice



skate, including shoe-attached skates of the popular tubular design. An ingenious support bears upon the sides of the skate alone, preventing the under side of the blade from being dulled by contact with metal, and giving a springy ride in gliding



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## With the Inventors

(Continued from page 20)

over the snow. . . . KEEPING A CAR WARM by heating a whole garage seems uneconomical to Augustus L. Clark, of Montpelier, Vt., so he has invented a special blanket for the car alone. It also may be used to advantage when the machine must be left standing outdoors for a considerable time. To



keep the radiator water from freezing, a front extension of the blanket frame forms a hood to accommodate a gas, oil, or electric stove. Heated air circulates between double layers of the reinforced blanket, and, emerging from holes in the inner layer, surrounds the car. If a gas or oil stove is used, a hole in the front of the blanket serves as a vent for the fumes. A second hole, nearer the floor level, admits air for combustion. . . . U. S. PATENTS ARE VALID in Alaska, Hawaii, and the Canal Zone; also, subject to certain regulation, in Puerto Rico, the Philippines, the Virgin Islands, and Guam. . . . A

HEADLAMP that illuminates shop work, while leaving both hands free, has been devised by Benjamin Cooke, of Hempstead, N. Y. Its lightweight, comfortable head clamp of metal spring wire supports the socket with its bulb and reflector, the latter being equipped with a visor to avoid throwing light into the



wearer's eyes. Semirigid rubber insulation keeps the electric cord, from the nearest outlet, clear of the worker's head. Additional insulation between the socket and the head clamp eliminates any possibility of electric shock. The invention can also be

(Continued on page 23)

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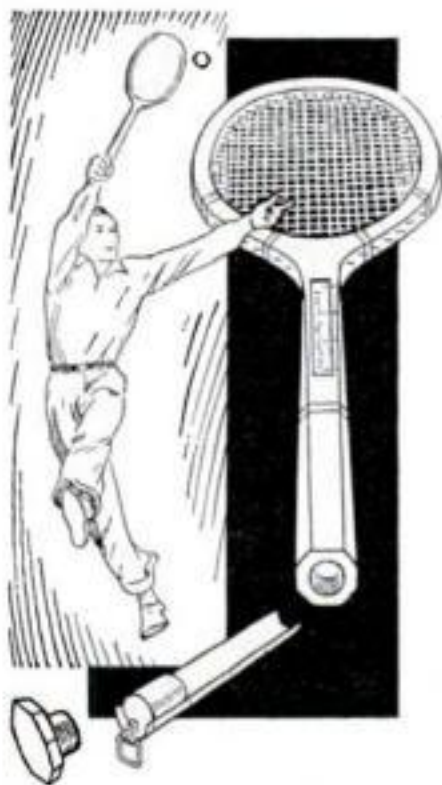


# With the Inventors

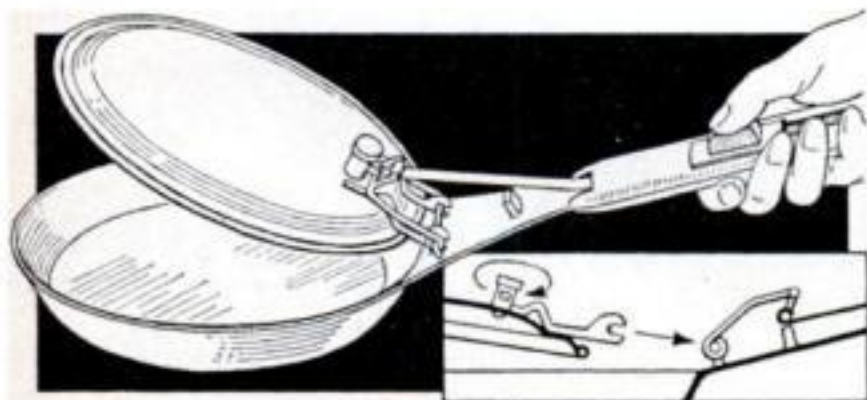
(Continued from page 22)

adapted to operate from any standard automobile battery, thus serving as a handy trouble light. . . . ONE OF THE YOUNGEST INVENTORS in the country is sixteen-year-old Seymour Golub, of Brooklyn, N. Y., who received a special award of merit for his invention of an automatic lighting device

. . . EVEN THE FUSSIEST of tennis players should be satisfied with a racket balanced according to the system of Mercer Beasley, of New York City. He takes care of them all—the novice who finds a normal racket too hard to swing, the advanced player who wants more weight behind his stroke, and stars who would vary the balance of favorite



rackets for clay and grass courts. A notched rubber weight, interchangeable in various compartments of a semicircular sheath, is simply slid into a tight-fitting hole in the handle. This compresses the metal sheath so that sharp points on it grip the rubber, and a screw cap at the base holds sheath and weight firmly in place. The exterior of the handle bears a scale to aid in obtaining or duplicating the correct adjustment. . . . By providing a frying pan with a lid and a convenient lifter for it, John F. Fratis, of Represa, Calif., does a good turn for housewives and campers. Burning-hot grease



cannot spatter while the lid is in place. To inspect the contents of the pan, the lid is raised simply by drawing back the thumb against a knurled slide on the handle. Releasing the slide allows the lid to close without jarring. Whenever desired, the lid and lifting mechanism may be detached.

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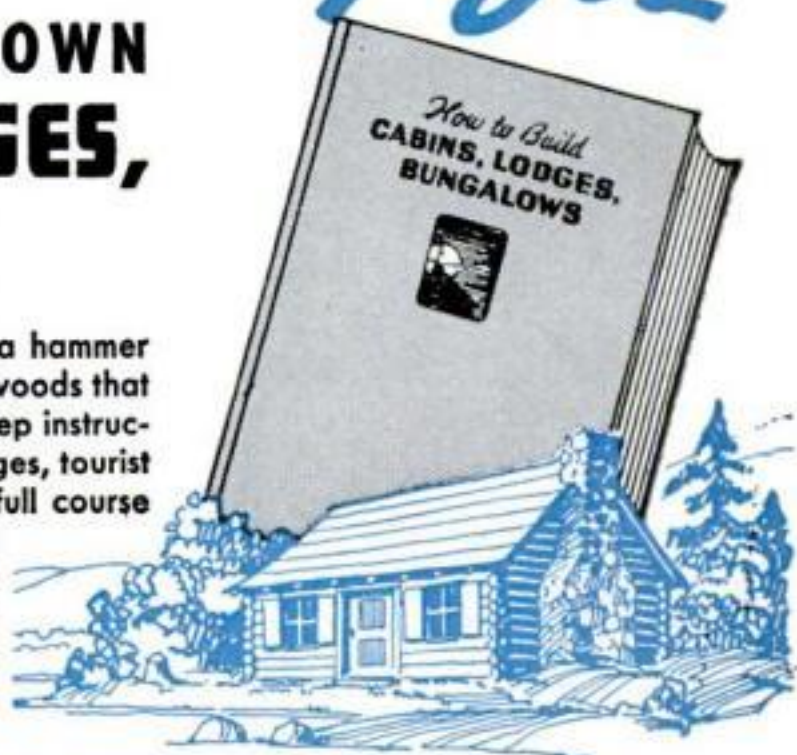




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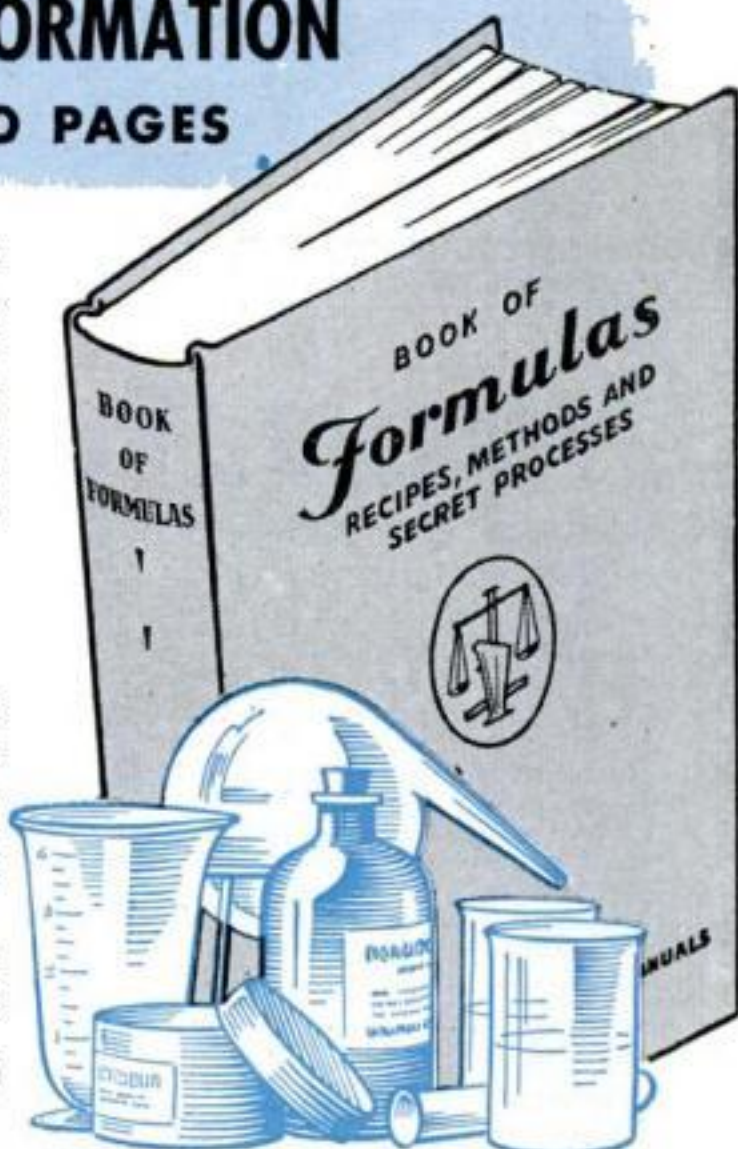
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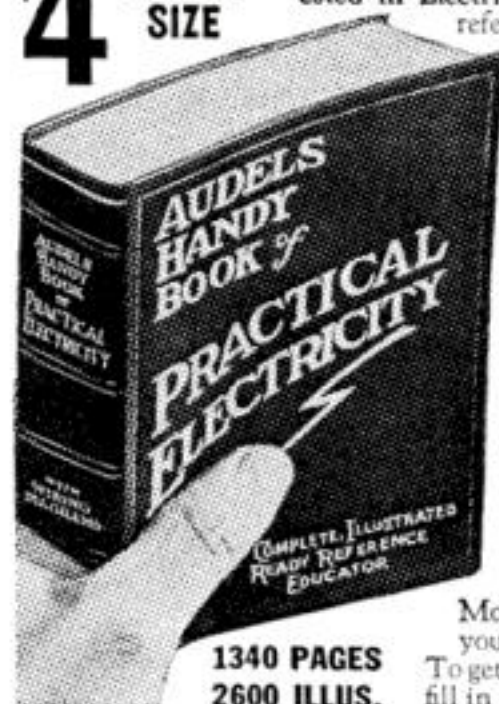
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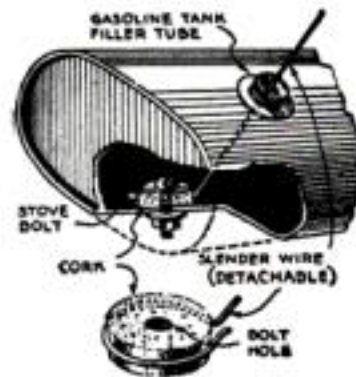
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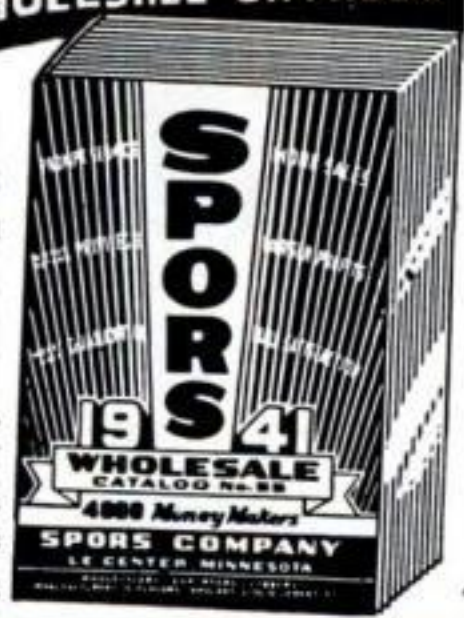
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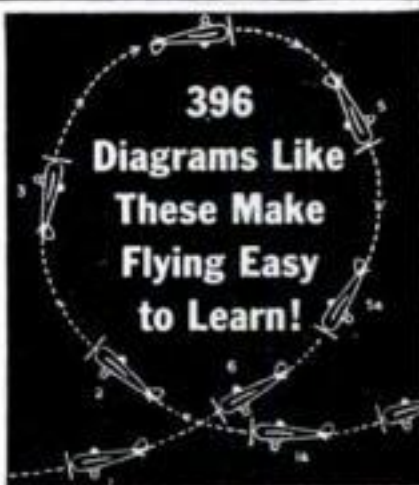
U. S. AIR CORPS, RES.

Formerly Chief of Training, U.S.A.C. Commander, 1st Pursuit Group, A.E.F.



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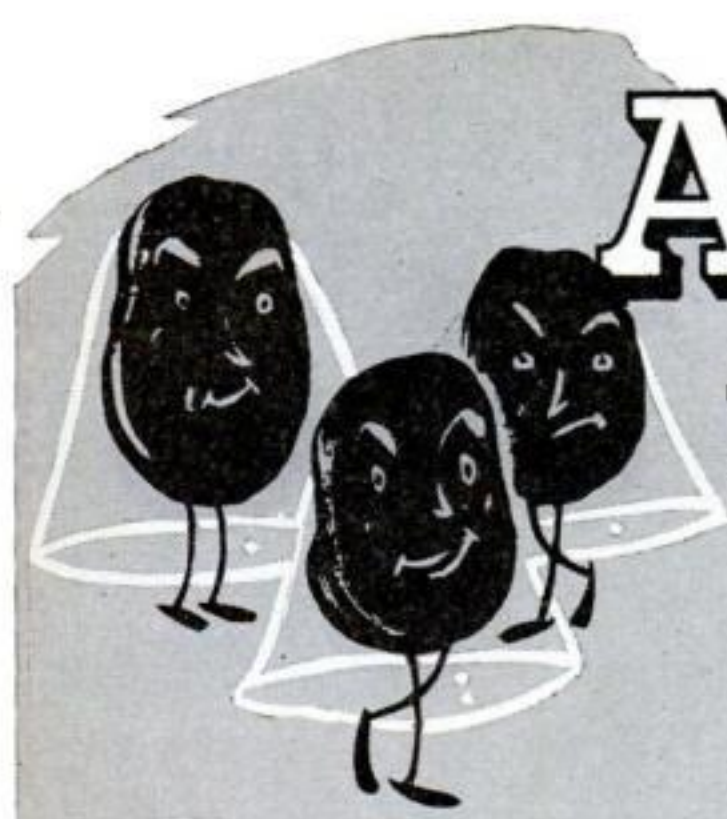
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## ADVERTISING

**MAIL-ORDER** or agent ad reaching 1,000,000 families throughout United States \$14.00 inch. Newspaper, magazine, mailing-list, ratebook, free. Chicago Advertising Agency, 20-SP West Jackson, Chicago.

**LEARN** Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue, Dept. 1741, Chicago.

**DISPLAY** Advertising, 205 newspapers agree line \$1.47; Fidelity Advertisers, K-3838 Washington, Chicago.

**ADVERTISE:** 24 words, 149 newspapers, \$6.50. Lists Free. Advertising Bureau, 4515-P Cottage Grove, Chicago.

**SPECIAL—Inch Display Adv.** 40 magazines yr. \$15. Wood's Popular Service-s, Atlantic City.

## AGENTS WANTED

**MYSTERY** Invention, carried in pocket keeps hands, feet, ears, body comfortably warm on coldest days. Lasts years. Stays warm 10 to 12 hours. Uses cigar lighter fluid—refills one-half cent. Everybody buys—workmen, housewives, schoolboys, farmers, sportsmen, spectators. Sell football games and other out-door gatherings. Low prices. Big profits. Write quick. Kumfy Warmer, Dept. E-2308 Eastern Ave., Cincinnati, Ohio.

**DON'T Be a Job Hunter—Start your own business** on our capital. No hard times; no lay-offs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, dignified, profitable business backed by world-wide industry. Write Rawleigh's, Dept. A-U-PSC, Freeport, Ill.

**MAKE Big Money** demonstrating amazing Handyman tool, 101 uses. Pulls posts, roots, small stumps; jacks up trucks, tractors, wagons; lifts buildings; stretches fences; splices wire; makes cider press; dandy auto bumper jack, etc. Lifts, pulls, pushes with 3-ton power. Write. Harrah, Dept. M-73, Bloomfield, Ind.

**LOCAL Agents** wanted to wear and demonstrate suits to friends. No canvassers. Partial payment plan. Up to \$12 in a day. Experience unnecessary. Valuable demonstrating equipment, actual samples Free. Progress Tailoring, Dept. N-221, 500 Throop, Chicago.

**GOOD Sideline** for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also make money applying initials on automobiles. Free Samples. "Ralco," 1305 Washington St., Boston, Mass.

**CALL** on Service stations, factories, restaurants, businesses, professions; with lettered advertising uniforms, shirts, work suits, etc. 100 styles. Exclusive features. Big advance commissions. Free outfit. Topps, Dept. S-24, Rochester, Ind.

**OPPORTUNITY—Limited number, men.** Crime-Alarm, Box 21, Bath-Beach Sta., Brooklyn.

**ENGRAVED** name plates, number plates, Signs, profits large. Brett Bros., Elmwood Ave., Winthrop, Mass.

## READ CAREFULLY

These Classified Advertisements, under more than 110 classifications, contain a gold-mine of interesting, useful information. Among them you'll find many money-saving and money-making opportunities; new products and services. Make it a habit to read this section every month. It pays.

**MAGIC** Clothes Brush. Revolutionary invention. "Erases" dirt like magic. Saves drycleaning. Sensational seller. Samples sent on trial. Rush name. Kristee 123, Akron, Ohio.

**SCHOOL Seniors—Sell Graduation Cards.** America's largest, fastest selling display. 30% Commission. Free Cards. Universal Engraving & Printing, Box 745-E., Pittsburgh, Penna.

**AT home,** your own manufacturing business, making popular \$1.00 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. R-824, Cincinnati, Ohio.

**AGENTS:** Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet, Elite Co., 214-A Grand St., New York.

**GOOD** Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. G, Decatur, Ill.

**SELL** bankrupt clothing bargains from home, store, auto. Shoes 15c—Men's suits, overcoats, 75c—dresses 10c. Experience unnecessary. Free wholesale Catalog. Superior Jobbing, 1250-LA Jefferson, Chicago.

**WILL** you give us 5% first \$600 you make? Afternoons free! Work home! \$1,000 month reported (exceptional—fulltime). Expect surprise! National-3, BX1240, San Bernardino, Calif.

**NEW!** Sensational! Push-Button controlled gas tank lock. Electric—operates from dash. Sold on new Graham. Great for Christmas presents. Agents, Dealers, write today. Snap-Up, Ashland, Ky.

**SELL** products of universal appeal. Prospects everywhere. Your own business with income governed by your own ability. Write promptly. Burlite Company, Orrville, Ohio.

**SELL** dresses low as \$1.24. Hundreds sensational bargains. Actual samples free. Send dress size, age, Harford, Dept. R-245, Cincinnati, Ohio.

**HIGH School Seniors!** Make good money selling our Graduation Name Cards. Biggest commission. Season starting. Hurry! Craftcards, Box 235, Pittsburgh.

**ATTENTION!** Neu-Gauz costs you \$12.75, gross. Large 50c package. Your profit \$59.25 per gross! Write today! Neu-Gauz Co., Omaha, Nebr.

**AGENTS—Men's suits** 88c, pants 23c. Overcoats 41c. Ladies coats 36c. Dresses 10c, sweaters 25c. Other bargains. Catalog Free. Portnoy, 566-AJ Roosevelt, Chicago.

**FREE** water and our concentrates make 68 products. We supply labels, bottles. Enormous profits. Qualco, F-20030 Russell, Detroit.

**COIN** Checks: Slugs, razor blades, trick playing cards, etc. Rush 10c for sample layout. Low wholesale prices to agents. Devere Novelty Co., Dept. 37, Dayton, Ohio.

**YOUR** ad in this Classification will reach productive sales-getters for your products or services. Rates on request. Popular Science Classified, 353 Fourth Ave., N.Y.C.

**AGENTS—300% Profit** selling Gold Leaf letters; stores and offices. Free samples. Metallic Letter Co., 437 North Clark, Chicago.

**OPERATE** steady business resilvering mirrors, making chipped glass nameplates, signs. Write Sprinkle, Plater, 910, Marion, Ind.

**SILVERWARE** instantly cleaned. Simply dip and dry. Amazing demonstration. 600% profits. NuProcess, Dept. 81, Aurora, Ill.

**LORD'S Prayer,** on real pennies—individually mounted on good-luck cards—Sure winner, \$6.00 Gross. Samples 75c dozen. Perkins, 1109 Lawrence, Chicago.

**WINDOW** sign letters. Penny each. Large sizes. New styles. Absolutely beautiful. Free samples. Atlas, 7941-R Halsted, Chicago.

**FREE** sample—amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Besco, 5009-X, Irving Park, Chicago.

## AIR CONDITIONING

**FURNACE** Blowers—\$22.50 up; attic blowers, cooling blowers and air conditioning blowers—all sizes. Guaranteed. Write for literature. Reynolds Mfg. Co., 412 Prospect Ave., N.E., Grand Rapids, Mich.

**ELECTRICAL** Deodorizer, controls, eliminates and purifies all odors quickly. Air Purification, 2524 Grand Ave., Detroit, Mich.

## ANTIQUES, RELICS INDIAN GOODS

**INDIAN** relics. Confederate bills, coins, gems, crystals, minerals, curios; catalog 52 illustrations 5c. 100 ancient arrowheads \$3.00. Tomahawk head 50c. H. Daniel, Hot Springs, Ark.

**12 BEAUTIFUL** Tiny assorted Flint Bird arrowheads \$1.20. Satisfaction Guaranteed. Virginia Curio Shoppe, Blackwater, Va.

**SWORDS,** Rapiers, Daggers, Pistols. Catalog 10c. Robert Abels, 860½ Lexington Avenue, New York.

**30 GENUINE** Indian Arrowheads, \$1.00. Catalog, Geo. Holder, Glenwood, Ark.

## AUTHORS' SERVICE

**SHORT** Stories revised, typewritten, marketed. Hursh, Box S-1013, Harrisburg, Penna.

## AUTOMOBILES

**SAVE** your battery. Don't let cold weather starting stall your auto or truck. Now starting made easy and quick. Complete instructions 25c. Advance Laboratories, 2112 West 51st, Chicago.



**THIS** is what you have been looking for: New method Dual-Vacuum Governed Crankcase-Valve Chamber Sludge Preventor. Removes all sludge-forming piston blowby vapors from inside of engine before they can condense to water and sludge. Combined Top Oiler. No maintenance-oil lines-moving parts or filters. Fool proof. Guaranteed. Endorsed. Folder. For International Trucks (HD-FAB Motors); GMC (AC Models); Ford 85; Mercury; Dodge; Chevrolet; Plymouth; DeSoto; Fargo. Give model, year; if truck or car. \$7.50 Prepaid, Thermo-Syphon, Miami, Oklahoma.

**SUPERCHARGERS \$3.00.** Guaranteed mileage increase 20%; power 10%. University of Detroit test. Any car; give make, year. Wrench installs 15 minutes. John Hanley, Manufacturer, 5719 Loraine, Detroit, Mich.

**PROFESSIONAL Midget racers, two-passenger roadsters, Midget motorcycles, motorscooters.** Guaranteed motors, wheels, parts, plans. Handbook catalog—90 illustrations—20c. Midwest, Box 1959-BG, Chicago.

**GASOLINE** saving device. 50c. Ford 1934-1940; Chevrolet, 1935-1940. Walert Co., 3429 No. 10th St., Milwaukee, Wis.

#### AUTO SUPPLIES & EQUIPMENT

**CONVERT** your car to burn Diesel oil. Save up to 70% fuel costs. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular No. 3. Harrington Company, 201-204 Manchester Bldg., Portland, Oregon.

**FUEL** oil conversions—For automotive, marine engines. Write for free literature. Houston & Logan, 2112 Addison, Berkeley, California.

**BARGAINS**—Welders, compressors, battery chargers, car washers. Liberal trial terms. Write Hobart Equipment, Box P-113, Troy, Ohio.

#### AVIATION

**AVIATION** wants more Lincoln Trained men for positions as Airline Mechanics, aeronautical engineers, airplane factory mechanics, commercial pilots. This Lincoln Government Approved School of Aviation placing graduates in fine big pay positions. Opportunities for many more. Courses from 8 weeks to 2 years prepares for immediate employment. Reasonable rates. Write Today for information. Lincoln Aeronautical Institute (Inc.), 2105 Aircraft Bldg., Lincoln, Nebr.

**AIRPLANE** and engine mechanics book. 1940 edition prepares for government examinations. \$3.00 postpaid or C.O.D. Quiz System, 1435 Flower St., Glendale, Calif.

**AVIATION Apprentices:** Air-minded Young Men interested in Technical training for entering Aviation as Apprentices see ad on page 43.

**AVIATION** Blueprint Reading Course. Send 3c. Postage for information. Baltimore School of Aviation, Box 32, Hamilton Sta., Baltimore, Md.

**PROPELLERS.** All types. Catalog 10c. Banks Propeller Co., Love Field, Dallas, Texas.

**AIRCRAFTED** Ford, Powerful Aircraft, Snowsled engines, \$82.50. Conversion, \$39.50. Lightning Aircraft, St. Paul, Minn. GAS motor power airplane catalog 5c. Polk's, 429 Seventh Ave., New York.

**LEARN** to fly free. Folder, dime. Ohmeyer, Box 391B, Hempstead, N. Y.

#### BATTERIES, GENERATORS, ETC.

**EDISON** lifetime storage batteries for light and power. Eliminate acid battery diseases. Long guarantee. All kinds rebuilt generating plants, motors, and miscellaneous articles at bargain prices. Free interesting literature. W. Hawley Smith Company, Croton Falls, N. Y.

**GENUINE** Edison Batteries for power, light. Non-acid. Fifteen year life. Five year unconditional guaranteed. Low prices. Complete lighting plants. Free literature. See-Jay Company, 87 Sterling Ave., Yonkers, New York.

#### BLUEPRINTS & PLANS

**900 TELUHOW** Plans; Explained, Simple; Useful; Interesting. For Homecrafters of all Ages. List, 10 cts. Charles A. King, E. Kingston, N. H.

#### BOATS, OUTBOARD MOTORS, ETC.

**OUTBOARD** Motors. Used and Rebuilt. Save money. Used parts. Bargain list free. Crandall-Hicks, 955 Commonwealth, Boston, Mass.

**FULL** size, cut-to-shape Boat patterns, blueprints and specifications. Big selection. Bargains. Send 10c (coin) for illustrated catalog. Book, "How to Build Boats", \$1.00 postpaid. Cleveland Boat Blueprint Co., Station A-77, Cleveland, Ohio.

**MARINE** Power. Easily convert any Ford motor (domestic and foreign) with Osco Parts and Kits. Complete Catalogue 25c (coin). Osmitson, 3648-P Lawrence St., Philadelphia, Pa.

**MARINE** Conversion Parts for all auto engines. Buy here and save. Conversion Parts Co., 277 Adams St., Boston, Mass.

**KAYAKS.** Outboards. Rowboats. Duck Boats. Weldwood ready-cut kits. Catalog I. Cre-Craft Boats, Millburn, N. J.

#### BODY-BUILDING COURSES

**COMPLETE** Course in Body-Culture explains simple rules for sound health. Only \$1.00 postpaid, with Free Copy of 12 exercises from the \$25 English Height Increase and Stretching Course. Satisfaction guaranteed or money refunded. Olympic System, Waterville, Maine.

**EXERCISE** equipment, courses. Special offers! Free booklet. Good Barbell Co., Dept. 6, Reading, Pa.

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We have been consistently advertising in your classified section and we expect to continue our copy as long as we are in the mail order business. No need to keep constant check on results from Popular Science—we always KNOW it is TOPS in Results!

G. E. Hendrickson,  
Three-M Service  
Argyle, Wisconsin

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**LOVE** Diary—Deluxe, illustrated; privately published. Originally \$5.00. Now only \$3.00. Economy Edition, \$1.00. Refund guarantee. Poets Corner Press, Palisades Park, N. J.

**5c** BUYS back dated magazines. Domestic, Foreign, Art, 100,000 used, new books. Catalog 10c. (refunded). Cicerone's, 863(S) First Ave., New York City.

**LIGHTNING** Shorthand self-taught 25c. Typewriting self-taught 25c. 64 pages each. Both 40c postpaid. Clifton Company, McKinney, Texas.

**SENSATIONAL** Mexican, Cuban, Art Pictures, books, miscellaneous; Sample. Lists, 50c. Jordanart, Cedarway, 16S, Boston.

**FREE!** Christmas Book Catalogue! Write: Old Prof's Book Shop, 516 Arcadia Ct., Pontiac, Mich.

**SNAPPY** books, pictures, novelties, etc. Where to get. We tell you. List only 25c. Esse, 5000-A Cordelia Ave., Baltimore, Md.

**PRETTY** Girl art photos, books, novelties. Big assortment \$1. Catalog 10c. P. S. Braun, 353 W. 47th, Chicago.

**PHOTOGRAPHS:** Listings and Sample 12c. Albert S. McGoldrick, Mansfield, Mass.

#### BUILD IT YOURSELF

**BUILD** your own machine tools. Equip your shop at big savings. We furnish Castings, materials, blue prints for milling machine, shaper, band saw, and 21 other metal- and woodworking tools. Send 10c for new 1941, 32-page, illustrated catalog. Lewis Machine Tool Co., Dept. S-1C, Box 116, Station A, Los Angeles.

**MOTORSCOOTERS.** Midget cars! Easily built. Complete plans and literature on wheels, tires, motors, transmissions, clutches, etc., 10c. Honsaker, Masontown, Pa.

**BUILD** power Scooters, midget cars. We supply tires, wheels, motors. Lowest prices. Send 10c for plans, etc. Bild-Ur-Own Devices, Dept. 1B, 536 North Parkside, Chicago.

**MIDGETS—Racers—Motorscooters.** Build now while prices lowest. Catalog finest plans, parts, building kits, 10c. New list 100 used motors, midgets, parts, 20c. Shipps Midgets, Box 543-K, Zanesville, Ohio.

#### BUSINESS OPPORTUNITIES

**PLASTEX** Industries offer industrious men an opportunity to start a business of their own, manufacturing art goods, novelties and utility products in Plastex and marble imitation. 1/2c material makes regular 10c store seller. Rubber molds furnished for speed production. Small investment brings big returns. We are now placing big chain store orders with manufacturers. Ambitious men have chance for real prosperity. Plastex Industries, Dept. S., 1085 Washington Ave., New York, N. Y.

**BUILD** your own Business. Popular Science Classified Ads will introduce your products into over 600,000 homes every month. These small ads have built big businesses for many men starting in the mail-order field. Send us a description of your products. We will prepare advertisements and submit them to you for approval. Address Class. Adv. Dept., Popular Science Monthly, 353-B Fourth Ave., New York.

**MEN** now calling on farmers, poultry raisers! Materially increase your income taking orders for Big Boy Chicks, "America's Finest". Full or part time basis. Backed by extensive National advertising. Restricted territory franchise includes the famous Big Boy Chick Raising Plan. Get details immediately. Illinois State Hatcheries, 205 Jefferson, Springfield, Ill.

**IF** you have some spare room where you can do light work, we can offer you a profitable proposition casting Xmas goods, 5 and 10c novelties, ashtrays, toy autos, etc. for firm of many years standing. No experience necessary as we furnish full instructions with moulds. Spare or full time. For details write: Metal Cast Products Co., Dept. E, 1696 Boston Road, New York City.

**START** home business making statuary; plaques; art goods; novelties; souvenirs; concrete pottery; garden furniture; artificial marble flooring; liquid marble. Make your own flexible molds. Amazing profits. Valuable folder free. Creative Publishers, P. S. 1, Glencoe, Ill.

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**COLOR** Concrete with chemicals. Stucco-rock. Cement Artistry. Wishing-wells. Spin concrete pottery. Benches. Garden Ornaments. Cold-glaze, concrete-paints, marbling. Sample 10c. Hollywood Cement-Craft, 8530 Wonderland, Hollywood, Calif.

**INVENTORS**—Patent your invention. Secure booklet "How to Protect Your Invention." No obligation. McMorro and Berman, Registered Patent Attorneys, 143-G Barrister Bldg., Washington, D. C.

**MEN—Women,** operate "Specialty Candy Factory" home. All or spare time. Opportunity for steady income. (Our 32nd year). Booklet free. Ragsdale Candies, Drawer 14, East Orange, N. J.

**WILL** you give us 5% first \$600 you make? Afternoons free! Work home! \$1,000 month reported (exceptional—fulltime). Expect surprise! National-4, BX1240, San Bernardino, Calif.

**MAIL** Order spare-time or full-time business enterprise. Gather, "edit" and sell names for advertisers. Details Free. C. N. Schroeder, 56 West Washington, Chicago, Ill.

**START** profitable home business manufacturing Soapless Suds. Amazing discovery. Eliminates hard scrubbing. Costs 1c quart. Formula, sample 25c. Details free. Linothex, 14006 Coit, Cleveland.

**GOOD** Paying Business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. E, Decatur, Ill.

**ADD** to your income this winter! Grow mushrooms in spare time in cellar, shed, garage. We buy all you raise and furnish materials. Write today for big, Free Book. United, 3848-AE Lincoln Ave., Chicago.

**ENORMOUS** profit possibilities. Sell by mail. Your own business. Quick profits. 120 money-making plans. Formulas. Full particulars Free. Monarch Publications, 715B Haas Bldg., Los Angeles.

**FREE**—200 clever mailorder, homework, local business, agency offers—all snappy money-makers. Lewis Co., 828-A Carpenter, Oak Park, Ill.



**MAKE your Mail Order Business Pay!** Use genuine original letters of Mail Order Buyers. Particulars Free! Crown Mail Order, 164SP Monroe St., New York.

**FOR Free Information** concerning an extremely profitable, lifetime business, write Cole Associates, Syracuse, N. Y. immediately.

**SWISS Music Box works**—\$1.25 to \$2.10. Suitable for many novelties. Mermord Manufacturers, 147 West 46th St., New York.

**127 WAYS to make money**, in home or office, business of your own. Full particulars free. Elite Co., 214-A Grand St., New York.

**SUCCEED with your products.** Make-sell them. Formulas. Processes. Accurate analyses. Catalog Free. P. Thaxly Co., Washington, D. C.

**MAKE color-glazed concrete pottery**, gravestones, tiles, floors, walls. Basement waterproofing, etc. Booklet, 3c stamp. National Pottery, Minneapolis, Minn.

**LIQUID marble.** Anyone can make! Brushed, sprayed, molded! Colorful, glazed. Particulars free. Marbleizing Service, Edwardsville, Ill.

**WORK already done for you.** Publish interesting, profitable mail order magazine. Sample, instructions, etc., 25c. Thyben, Publisher, R. 2, Freedom, Maine.

**FREE literature** describing many money-making plans. A. Flury, 1602 Locust, Des Moines, Iowa.

**"MAILORDER Directory"**—300 firms listed; 51 classifications—15c. Kraft Publications, Syracuse, N. Y.

**FILING Saws** easy this new way. One dollar hour easy. 25c brings instructions. Harvey Pickett, Garden City, Iowa.

**T\*PISTS**—We can use your spare time. Details stamp. Richmond Service, 504-54 Broadway, Sterling, Ill.

**HOME Business.** Free literature shows way. Vosacek Press, 1634-6A Monroe, Chicago.

**TURN Tin cans into money.** Instructions 25c. Chaney, 1130 E. 16th St., Jacksonville, Fla.

**HOW and where to obtain capital.** Particulars free. Star Service, Wapakoneta, Ohio.

**MAIL and distribute circulars;** wonderful opportunity. Miracle Factories, Conshohocken, Pa.

**INVENTION Finance Magazine.** 80-N Wall Street, New York. For inventors. Free particulars.

**RUBBER-Mold making.** Plaster casting. Instructions 25c. Kemikon, 179, Parkridge, Ill.

**WHERE to buy at lowest wholesale prices.** Information free. Yorena, Box M-312, Bayonne, N. J.

**RAISE Canary Birds for us.** Catalogue information 10c. Houck's, Dept.-4, Tiffin, Ohio.

**SELL by Mail!** Books, novelties, bargains! Big profits! Large Catalog Free! Elfco, C-438 North Wells, Chicago.

**CASH In.** 68 page book. 300 tested profit makers, business starters. Postpaid 25c. Wolverine, 202 West 20th, Holland, Mich.

**MAKE door mats from tires.** Profits guaranteed. Instructions \$3.00. Thomas Kowell, 5372 St. Clair, Detroit, Mich.

**UNUSUAL Opportunity!** Auto radio Specialists earn \$1.00 hourly. Write 392, Elmira, N. Y.

**RAISE Angora Rabbits**—Wool brings \$5.00 pound. Particulars Free. Grinstead's, Carrollton, Ill.

**"INDEPENDENT Operator"**—Professional mailorder magazine—10c. Kraft Publications, Syracuse, N. Y.

**MOLD making, plaster casting.** Foolproof rubber. 24 page instructive catalogue free. Plastic's, 711 Neely, Muncie, Ind.

**HANDY men**—Earn money home operating Community "Fix-It" Shop. Stafford, 708 Rawlings, Carbondale, Ill.

**RECAST old batteries into new.** Latest achievements. Battery Laboratories, St. Paul, Minn.

**GREAT Money-Making opportunities!** Vassar Service, 332 Washington, Hoboken, N. J.

**CONVERT tin cans into steel scrap,** valuable tin. Two processes 50c. Harry D. Cater, 1601 East 14th Ave., Denver, Colo.

**STEADY Home Business.** Whole plan 50c. Saunders, Forest Glen, Md.

**300 MONEYMAKERS**—68 pages; no advertisements—25c. Kraft Publications, Syracuse, N. Y.

**MAKE genuine rubber molds.** Details free. June, 101-A Beech, Holyoke, Mass.

**MAKE extra money with salesboards.** Write Johnson's, Box 1562, Baltimore.

#### BUSINESS SERVICE

**1,000 ORIGINAL letters**—Agents and mail order buyers—\$4.00. Particulars Free. Crown Mail Order, 164-PS Monroe St., New York.

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**SAVE** 60% on Movie Films. Send stamp for sample and circulars. Genera Company, Davenport, Iowa.

**ART** Films, Lists Free. Sample 10c. Parkway Exchange, 961 Eastern Parkway, Brooklyn.

**FREE** Sample and lists; movie films. Goodwill Company, Jackson, Tenn.

**ADULT** Films! \$5.00 Lightmeters! Catalog, Lens Cleaner, 10c. 392, Elmira, N. Y.

**ART** Films. Sample, dime; catalog free Cine, 4224 Lincoln, Chicago.

**ARTFILM!** Sample, catalogs, gift offers, dime! Parisian, 4228-B Lincoln, Chicago.

**UNUSUAL** Art Catalog; sample film dime. Erwine's Laboratories, Allentown, Penna.

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**MOTORIZED** your bicycle with Midco 4-cycle power unit. Fits any standard bicycle. Send dime for installation instructions and price. Midco Manufacturing & Distributing Company, South 13th and Kentucky Ave., Sheboygan, Wis.

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**BICYCLE Motor-Outboard**, rides on own pneumatic wheel, junior and heavy duty models. Dept. SS, Richardson Mfg. Co., Aurora, Mo.

**NEW** and used motorcycle parts and accessories. Elmer Nelson, LaMoille, Ill.

#### MUSIC, MUSICAL INSTRUMENTS

**MUSIC** composed to words. Rhyming Pamphlet on request. Phonograph recording of completed song. Send poem. Keenan's Studios, Dept. PS, Box 2140, Bridgeport, Conn.

**ORIGINAL** music composed to your words \$5. Song recording, printing, orchestrating. Reginald Belcher, Chatham, New Jersey, 30 years church organist.

**PHONOGRAPH** Records 10c. Catalogue. Paramount, MJ-358 East Market, Wilkes-Barre, Penna.

**SONG** Poems wanted. Free examination. McNeil, Master of Music, 510-PS South Alexandria, Los Angeles, Calif.

**WANTED!** Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

**ORCHESTRATIONS** — Popular backnumbers, 9-51 complete. Silverman Musicmart, 3305 Lawrence, Chicago.

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**GOLD** \$35 ounce. Ship old gold teeth, crowns, jewelry, watches—receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Weisberg's Gold Refining Co., 1500-B Hennepin, Minneapolis, Minn.

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**ROSICRUCIAN** Secret Teachings are offered to those who seek to use them solely for the perfection of their inner faculties, and in the mastering of the daily obstacles of life; the International Organization of Rosicrucians will be happy to receive the requests of those who believe that worthiness and sincerity determine the right for one to have such wisdom; to them, a copy of "The Secret Heritage," a fascinating book, will be given without price; let this book guide you to the conservative plan whereby you may widen your scope of Personal Power. Simply address your letter to Scribe Q.M.C., Amore Temple, Rosicrucian Park, San Jose, Calif.

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**PSYCHO-ANALYSIS** \$1.00. Answer 100 questions. Confidential. Send 10c for questions. Mentplex Associates, 10 Depot Square, Englewood, N. J.

**SINUS** Trouble. If a victim of Sinus or Catarrhal Infection write National Laboratories, Benj. Franklin Station, Washington, D. C.

**FREE!** Christmas Book Catalog! Write: Old Prof's Book Shop, 816 Arcadia Ct., Pontiac, Mich.

**CONTEST** Bulletin. 22 Big pages contest helps. 10c. Contest Service, 1609-P East 5th, Duluth, Minn.

**LEARN** Ventriloquism, 3c stamp brings particulars. Smith, Room 786, 801 Bigelow, Peoria, Ill.

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**IMMEDIATE** Service! Pictures returned same day order is received. Sixteen guaranteed Deckled-Edge prints from roll, 25c. One colored or two plain enlargements plus 8 Deckled-Edge Velox prints only 25c. Special! Coupon for 8x10 enlargement given with each 25c order. Any 36 exposure 35mm film fine-grain developed Vaporate Treated and each good negative evaporated to 3x4 on Deckled-Edge Velox paper, only \$1.00! Reloads: 36 exposure, 50c; 18 exposure, 35c. 3x4 Deckled-Edge reprints, 4c each, 24 hour service. Details, sample and mailers free on request. American Studios, Box 52, La-Crosse, Wisc.

**TECHNIFINISH**—35MM., 36 exposure rolls including "Mercury" fine grain developed and perfectly enlarged to 3" by 4" glossy prints, 85c. New, exclusive methods and equipment make this low price possible. Cartridge reloaded with Eastman Plus X, 30c. One day service. Satisfaction guaranteed or money back. Write for free mailing bags and information. Technifinish Laboratory, 461-N Brown St., Rochester, N. Y.

**THIS** ad worth 10c to new users of our regular 35c service. As an introductory offer you get our 35c quality service for only 25c. This includes film developed, all prints enlarged, deckled, dated on Velox, free paneled enlargement, valuable premium coupons. Our work cannot be surpassed in quality. Send this ad, your film and 25c coin to Mail-N-Save, Box 310-32, Quincy, Mass.

**FREE**—One roll developed and printed free. Just to get acquainted, we will beautifully develop and print your first 6 to 16 exposure roll Free plus 5 x 7 inch enlargement Free, also sensational, new folding folio to frame your prints, all free with this ad. (Enclosing 10c for handling and mailing appreciated). Dean Studios, Dept. 1040, Omaha, Nebr.

**FOR** the Discriminating Amateur—8 exposure rolls, 2 prints each 25c. Miniature rolls enlarged 3 to 6 times, 8 exposures 25c, 16 exposures 50c. 35mm 36 exposures, 3x4 enlargements \$1.00. Christmas cards from your negative, embossed, deckled, 10 for 49c, sample 5c. Unexcelled quality, prompt service. Paramount Photo, 327 E. 92nd St., New York.

**FINER** Finishing specials 25c. 6 or 8 exposure roll developed. Your choice—16 prints or 8 prints with 2 professional enlargements or 8 prints and one colored enlargement. Genuine Moen-Tone Nationally known superior quality. Established 1899. Moen Photo Service, 200 Moen Bldg., La Crosse, Wis.

**PHOTOGRAPHY** for pleasure and profit. Prepare for profitable business or fascinating hobby at home. Common school education sufficient. Write for information and requirements. American School of Photography, 3601 Michigan Ave., Dept. 172C, Chicago.

**OVERSIZE** Prints. Your roll developed and 8 oversize prints 25c; from 116, 120, or 127 size negatives you receive 4x6 inch prints. All smaller sizes receive 3 1/4 x 4 1/2 inch prints. Reprints 3c each. Overnight service. Pacific Photo Service, Box 666, San Francisco, Calif.

**8 ENLARGEMENTS** and films developed, 116 size or smaller, 25c coin. Special Offer: enclose this ad and negative for double weight hand colored enlargements Free. Enlarge Photo, Box 791, Dept. PSM, Boston, Mass.

**ROLL** developed 6 prints and two enlargements 25c. Beautiful photographic Christmas Cards or Calendars from your negatives, 4 for 25c; 17, \$1.00, envelopes included. Young Photo Service, 406-C, Albany, N. Y.

**FREE** Trial—16 sparkling Lifetime prints, three lovely Hollywood enlargements and Free Leathertone frame with roll—25c. 20 reprints 25c; 100—\$1.00. Overnight service. Lifetone Studios, L-27, Des Moines, Iowa.

**18 LIFETIME** Prints, 3 sparkling Hollywood enlargements each roll 25c, 21 reprints 25c, 100—\$1.00. Finished 3 hours, 25 other bargains. Overnight Studio, Albany, Wisconsin.

**FREE**—3 professional 5x7 enlargements of your own choice, 2 guaranteed sets of prints with your roll film developed—all for 25c, original order only. Aro Studios, Dept. H, Des Moines, Iowa.

**ROLL** developed and 8 beautiful enlargements 2 to 6 times larger—deckled edge—high gloss. Any 8 exposure roll 25c coin. Reprint enlargements 3c each. Alden Photos, 258-C Astor Station, Boston, Mass.

**EXTRA** Special: Five—5x7 enlargements, 25c. Cardinal Photos, Summit, N. J.



**CANDID special:** 35 Millimeter rolls enlarged to 3½x4½, \$1.00. 18 Millimeter rolls, 60c. 3½x4½ reprints, 3c each. Brown Photo Company, 1910-60 Emerson, Minneapolis, Minn.

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**CHRISTMAS Cards:** Send negative, dime for samples. Enlargements: 8x10: 30c. 35mm developed. Photo-Hall, Box 12, Kingsbridge Sta., New York City.

**FINERFOTOS** for 35 years. Roll developed and 16 prints, 25c. Many other offers. Satisfaction guaranteed. Finerfotos, Box 898-18, Minneapolis, Minn.

**20 REPRINTS** 25c. 100—\$1.00. Roll developed 16 prints 25c. 5x7 enlargements 10c. 3—25c. Nordskog, 58, Maywood, Ill.

**ROLLS** developed, two prints each and two free enlargement coupons, 25c; reprints, 2c each; 100 or more, 1c. Summers' Studio, Unionville, Mo.

**ROLLS** developed—Two beautiful double weight professional enlargements, 8 Never Fade prints, 25c. Century Photo Service, LaCrosse, Wis.

**IDEAL** Photos beautifully finished with wide border, deckle edged, 25c per roll of 8 and Free enlargement. Ideal Photos, Box 2255, Paterson, N. J.

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**GUMMED**, perforated, stamp-size photographs. Negative unnecessary. 100—\$1.00. 25-50c. Wardwoode, SP-1, Wallingford, Conn.

**ROLL** Developed — 16 guaranteed prints, two coupons on enlargements, 25c. Smart Photo, Winona, Minn.

**16 OVERSIZE** Deckledged prints and two enlargements, 25c. Owlphoto PS2, Weatherford, Okla.

**PORTRAIT** Quality "Velour Black" enlargements 5x7, 25c. 8x10, 35c. Scrapbook Studio, LeMars, Iowa.

**8 4x6 ENLARGED** prints from your roll, 25c. Sunbeam Film Service, Box C-876, LaCrosse, Wis.

**PINEST** reprints 1c up. Free information. Write Contacto, Needham, Mass.

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**MAKE** more money raising poultry. Colored pictures of poultry and most common poultry diseases supplement valuable information. Six months 10c; two years 25c. American Poultry Journal, 576 South Clark, Chicago.

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**LOW** Factory prices on Poultry Equipment. Wire fabrics. Free 100-page catalog. Bussey Pen Products, 5151 West 65th St., Chicago.

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**PRINT** Anything reasonable. State requirements. Hamilton Press, 4341 N. Meade, Chicago.

**HAMMERMILL** Letterheads, envelopes, all colors. 32 styles type. Free particulars. Woodruffs', 217D Lewis, Duluth, Minn.

**WHOLESALE** Prices. Everywhere printed. Wholesale, 318-Z East McDaniel, Springfield, Missouri.

**\$1.00 POSTPAID**—100 8½"x11 Bond Letterheads and 100 envelopes. Benneville, 907 West Roosevelt, Philadelphia.

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**INEXPENSIVE** 6x9 printing press—Details free. Novelty Shop, Downsville, La.

**BARGAINS**—Presses, type. List 3c. Exchange, A-27, 190 Cook, Meriden, Conn.

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**WE** purchase all Indianhead pennies. Purchasing catalogues 10c. Waltman, 398 Broadway, New York.

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**REFRIGERATION** — Repairing instructions, plans; postpaid, \$1.00. Appliance, 5200E Delancey, Philadelphia.

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**CUSHIONED**. 2 lines 25c. 3-35c. Ours are better! Ad-Crafts, LaCrosse, Wis.

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**WANTED**. Poems, to be set to music. Submit for consideration. Transcription records made. Keenan's Studio, PS, Box 2140, Bridgeport, Conn.

**SONGS** and Song Poems wanted. No charge for melodies. Free examination. Hollywood Recording Studios, 87L4 Preuss St., Los Angeles.

**SONGWRITERS** wanted. Radio information. Publication. Greateastern Songbureau, 41PS1, Thomaston, Maine.

**SONGS:** Song Poems; bought, published. Best offer. Free advice. Metro-Melody Music Publishers, San Francisco.

**SONG** Poems wanted. Send poem for approval, free booklet. Five Star Music Masters, 6F Beacon, Boston.

**SONGS**, poems, considered for publication, royalty basis. Dept. S, Radio Music Co., 5517 Carlton Way, Hollywood.

**SONG** Poems wanted. Free examination. McNeil, Master of Music, 510-PS South Alexandria, Los Angeles, Calif.

**SONGWRITERS**. Write for free booklet, profit sharing plan. Allied Music Company, Box 507, Cincinnati, Ohio.

**WANTED!** Original song poems. Richard Bros., 146 Woods Bldg., Chicago.

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Readers are invited to take full advantage of the stamp offerings available through ads asking for *Approval Applicants*. Such applicants receive a selection of stamps on approval which may be purchased at prices indicated. Payment and return of undesired stamps should be made within ten days after receipt unless otherwise specified by advertiser. Applicants who fail to follow these instructions become subject to Section 2350, Postal Laws and Regulations, 1932, which provides extreme penalty for obtaining property by false pretense.

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**COLLECTORS** — Superb United States stamps including airmails, commemoratives, postage on approval. Freshly filled, correctly numbered booklets. Harvard Stamp Co., 194 Kelton St., Allston, Mass.

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**U. S. Commemoratives—25 different—10c.** Approvals, Quality Stamps, Englewood, Colo.

**55 SELANGOR, Bolivia, Ecuador, Palestine, Egypt, etc. Approvals 5c.** Libby Stampco, Station P, Box 43-E, Brooklyn.

**UNITED States \$4 and \$5 stamps Free to approval applicants sending 5c for 100 all different.** Winholt, Woodbine, Penna.

**50 DIFFERENT United States.** Many commemoratives, 5c. Gerhardt, San Saba, Texas.

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**AIRMAILS—Seven different U. S. Airmail 10c.** Elzea, Bowling Green, Ohio.

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**PENNY APPROVALS (50000).** Gulf Stamp Company, 178 Brookside, Irvington, N. J.

**100 U. S. revenues on documents—10c! (700—50c).** Vanvoorheis, Hyndman, Penn.

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**PLEASEING Penny Approvals!** Janice Swenson, 27 Collins Parkway, Meriden, Conn.

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**GUARANTEED** Factory rebuilt transits and levels for rent (with purchase option) or sale (cash or terms). We will repair, trade in, or buy your old instruments. Ship prepaid for cash valuation. Write for list P861 and complete information to Warren-Knight Co., 136 North 12th St., Philadelphia, Pa.

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Dept. 7,      13 W. 26th St.      Minneapolis, Minn.

JANUARY, 1941

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**86 DEGREES COOLER**

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## PUT THE INDIAN SIGN ON TONGUE-BITE

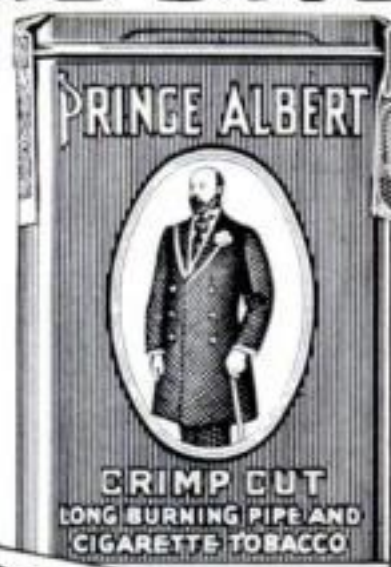
I PUT EXTRA-HOT SMOKES OUT OF MY LIFE. PRINCE ALBERT IS **SO EASY ON THE TONGUE— BURNS COOLER. IT'S NO-BITE TREATED!**



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50 pipefuls of fragrant tobacco in every pocket tin of Prince Albert

**PRINCE ALBERT** THE NATIONAL JOY SMOKE



# SOLDIER 1941

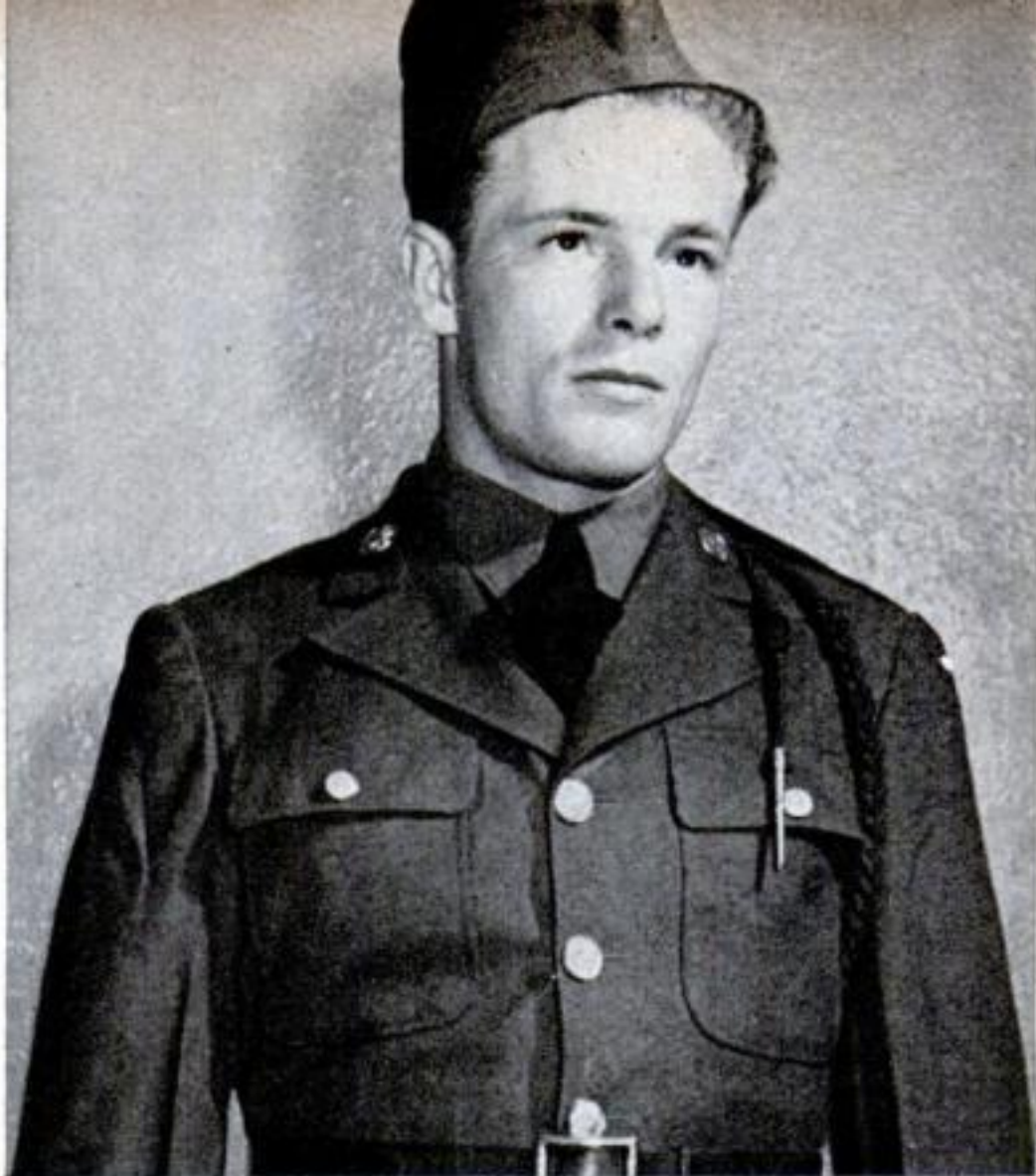


THE MAN OF THE MONTH:  
Larry Thompson  
is in the Army now





Photos by Ralph Morse



A few days before he donned a uniform at \$21 a month, Larry Thompson was loading scrap iron at \$2 a day

## A ROOKIE GETS HIS FIRST TASTE OF ARMY LIFE

LAWRENCE OTIES THOMPSON, of Norwich, N. Y., entered a new world over a recent week-end—a world of precision in which several hundred thousand young Americans will dwell with him within the next few months. On a Friday Larry was wrestling scrap iron in the freight yard of the Erie Railroad at \$2 a day; on the following Monday he was wrestling with the somewhat bewildering impact of army life at \$21 a month and "found."

The routine of his life, largely determined by his own preferences and impulses for most of his twenty-one years, had slipped suddenly into a mold whose detailed rigidity would have astounded the Medes and Persians and made Moses blink. It jolted Larry too, but he guessed that if the other members of Company L of the 18th Infantry could conform to it, he could too.

He got one good break. His first army job was noon dinner in the mess hall at Fort Wadsworth on Staten Island, N. Y., where the 18th Infantry, a part of the 1st Division, is stationed. At the dinner table laden with soup, fish, vegetables, bread and butter, apple tart, and coffee, Larry felt as competent as any of the other ten privates who sat down with a noncommissioned officer.

The fried fish, however, was followed by a lavish succession of wholly unfamiliar things. His bedding was in the basement

and Larry carried it up three flights to the bunk room to which he was assigned. He had had a room to himself at home, but in L Company barracks his home, like everything else, conformed strictly to government regulations.

It was sixty square feet of floor space and 600 cubic feet of air space. In the midst of his new home stood his iron bed, painted white. At the head of the bed was a metal locker for his heavy clothes. At its foot was a wooden rack for his shoes and a trunk for his small belongings. Larry discovered that regulations governed the making of his bed and the disposal of his belongings and were enforced through daily inspections. Twenty-nine other soldiers had their homes there, each with his sixty feet of floor space and 600 cubic feet of air space and each home more closely resembled its neighbor than those in a metropolitan suburb.

From the bunk room, still in his sweater and slacks, Larry went to the Quartermaster's office, where he received \$65.24 worth of new clothes and a lot of priceless information, both strictly regulation. He exchanged his \$1.98 oxfords for seven pounds of Size 7½ E shoes and his views on cravat-tying for the information that his black army tie must be tucked into the shirt, just below the third button.



Four numbers were confided to him with instructions to cherish them forever in his memory: his army serial number, 12,003,462; his company number, 131; his rifle number, 7285, and his clothing number, 3462. It was pointed out to him that the last four digits of his army serial number formed his clothing number.

The importance of bugle calls was impressed upon him until, already a little hazy in the head, Larry began to feel like an overworked echo of brazen notes, responding to Reveille at 6:15 a.m.; assembly at 6:30 a.m.; mess calls at 7:00 a.m., noon, and 5:00 p.m.; drill twice a day and Taps at 11:00 p.m. To add to his growing conviction that the abrupt transition from go-as-you-please civilian life to the regulated life of the Army was a highly confusing process, Larry discovered that he was a "John," in fact that all recruits were "Johns."

Within a few hours of his arrival at the post, Larry fell in with other Johns to listen respectfully to the Top Sergeant, Sam Lizer, a mighty figure of a man, who intoned appropriate passages from the Articles of War. This also, of course, is in accordance with regulations and is to inform the soldier of his rights and privileges and, more particularly, to warn him of the penalties for disregarding them. There is a reference to them in the oath of enlistment:

"I do solemnly swear that I will bear true faith and allegiance to the United States of America; that I will serve them honestly and faithfully against all their enemies whomsoever; and that I will obey the orders of the President of the United States, and the orders of the officers appointed over me, according to the Rules and Articles of War."

His conscience laden with the warnings of the Top Sergeant, his memory burdened with numbers and bugle calls and bed-making, and his schedule of physical assets encumbered with the sixty-five separate articles of equipment issued to him that day, Larry's head was swimming, but there was more to come.

He was yet to learn that in the Army there is a way to stand, a way to walk, and a way to turn and all other ways are non-regulation and anathema. He got a glimmering of this the next morning on the drill field. With other Johns he got preliminary instructions in forms of address—how to salute, whom to salute, methods of



At the recruiting office Larry gets a thorough check-up of . . .



**EYES**

Sight—20/100 minimum O. K.



**EARS**

Hearing—20/20 O. K.



**NOSE**

Nose—Negative, no obstructions



**MOUTH**

Throat and Teeth—O. K.





Larry arrives at Fort Wadsworth. His rail fare was paid by the Army

muscles of whose very existence he had been ignorant all his life. The Army believes in the good old remedy, "the hair of the dog," however, and muscle aches, like everything else succumbed to regulations on the drill field.

No sooner, however, had Larry gained a little confidence in his ability to swing right or left at command than complications beset him anew in the form of a nine and a quarter pound Garand rifle and the manual of arms. He discovered that, in whatever position the rifle was to be held, there was just one way of getting it there; all shifts of the piece must be made with prescribed motions, properly spaced.

Right shoulder arms, left shoulder arms, present arms, order arms, port arms, trail arms, inspection arms, sling arms—the orders followed each other in bewildering succession. Someone told him that there were 200 different orders in drill and Larry put the man down at once as an ultra-conservative, given to under-

reporting, and courtesy to superior officers.

At the afternoon drill, after a few limbering-up exercises, he was introduced to "the position of a soldier" and other preliminaries of close-order drill. "Belly in, chest out, head up, and heels together" were the elements and it astonished Larry, a well-coördinated young man, how frequently one or another of these elements eluded his control. Right face, left face and about face; column right, column left; right oblique and left oblique; right flank, left flank and to the rear, march; all these followed in quick order and by the end of the session Larry had learned the dynamic force of the command "March" and felt that he was doing as well as any of the other Johns.

IT ALL had been simple enough, really, he reflected—just a method of getting a group of men from one point to another in an orderly manner. It certainly was a lot easier than throwing scrap iron around. When he tumbled out at Reveille, however, Larry wasn't so certain. He had aches in

statement. Two thousand was more like it.

While he was resting between drills, Larry's corporal, John Bialobrzieski, who is known in the ranks as "Alphabet," gave him rudimentary instruction in the use of his first-aid kit and in making a marvelously compact pack of the tent pins, raincoat, blanket, socks, underwear, and numerous other articles which make up the field pack. When all have been properly assembled they make a tidy bundle that weighs only twenty pounds, though they would cover a blanket if strewn about.

As one detail after another of the new life was mastered, including a good deal of army slang, Larry gained confidence and began to glow with the pride of a snake in a new skin, though he felt that in him the changes were more than skin deep. He could not only handle his semi-automatic Garand briskly, he could take it apart and put it together again. Without self-consciousness he began to refer to the cook as the "slum burner," to the bachelor officers' quarters as "Snob Hill" and to the mess



sergeant as the "K.P. chaser." Incidentally, kitchen police in L Company is not a matter of discipline, but of rotation.

AS HIS confidence in his ability to order his life according to regulations grew, Larry began to discover that there was a lighter side to army life. Leave could be obtained to visit the city and there was a good deal of entertainment to be found at the post at small cost in his leisure hours.

Larry began to look forward to the completion of his fourth month in the Army, when his pay would be increased from \$21 to \$30 a month. New vistas opened out beyond that, too; a corporal draws \$54 a month and a sergeant, \$60.

That was something Larry hadn't figured on before. It hadn't occurred to him that a man might finish a three-year hitch with money in the bank, but he hadn't stopped to think that virtually all the ordinary expenses to which his \$2 a day had contributed in Norwich were settled for him now in advance. There was no rent to pay, no board bill, no clothes to buy, and medical and dental attention was free.

You earned your money in the Army, Larry decided, but, if you put your mind on it, you probably would be a lot more successful at saving it than you would be in Norwich. His final judgment was that Norwich had some advantages, but so did the Army. (Continued)

### EQUIPMENT AND CLOTHING ISSUED FIRST DAY

1 iron bedstead	2 pair shoes
1 mattress	1 pair canvas leggings
1 mattress cover	2 working suits
2 sheets	1 denim hat
3 wool blankets	1 web belt
1 pillow	1 pair wool gloves
1 pillow case	4 handkerchiefs
1 wool coat	1 necktie, black
1 wool overcoat	1 collar insignia, U.S.
1 raincoat	1 collar insignia, 18th Infantry
2 worsted shirts	1 forragere
2 wool trousers	2 cotton towels
4 cotton underdrawers	1 bath towel
4 cotton undershirts	1 toilet set, including razor and one blade
3 wool underdrawers	1 pair shoe laces
3 wool undershirts	1 pair legging laces
3 cotton socks	1 barrack bag
4 wool socks	2 identification tags
1 field cap	
1 winter cap	

TOTAL ITEMS - 65



To be sure of a perfect fit, Larry tries on sample shoes. His civilian shoes cost \$1.98. His Army shoes cost Uncle Sam \$6.30

Civilian shoes—size 8  
 Army shoes—size 7½  
 Civilian shoes—3 lbs.  
 Army shoes—7 lbs.



able with eleven others he got no Army beans . . .



out he did get soup, fried fish, three vegetables, bread and butter, coffee, and fresh apple tart.



After dinner he had the job of toting his bedding from the barracks supply room three flights



his bed. At home he had a room to himself.



Now he has sixty square feet in a room with twenty-nine others. Making his bed is a new experience.



Spreading his gear out on his bunk, Larry found it totaled sixty-five items. With his civilian





just in time to get a lesson in making up his pack.



His corporal showed him that there was quite a knack to packing a blanket, a half of a small canvas tent,



a raincoat, and twenty-seven other odds and ends into a compact twenty-pound bundle that would fit comfortably



in so little space. On the march, he'll carry the



pack, a cartridge belt, a canteen, bayonet and scabbard, and his nine-and-a-quarter-pound Garand rifle.

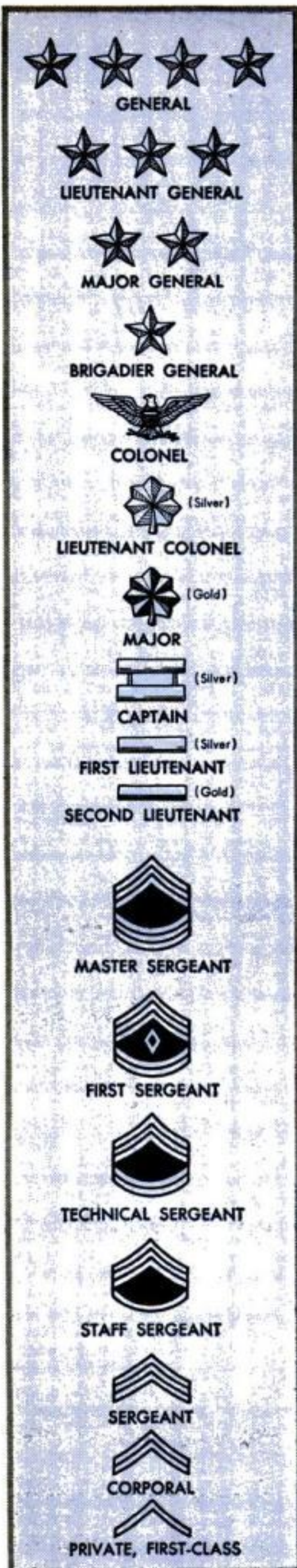


Eleven-o'clock taps brings the end of Larry's first Army day and the beginning of a brand-new life.





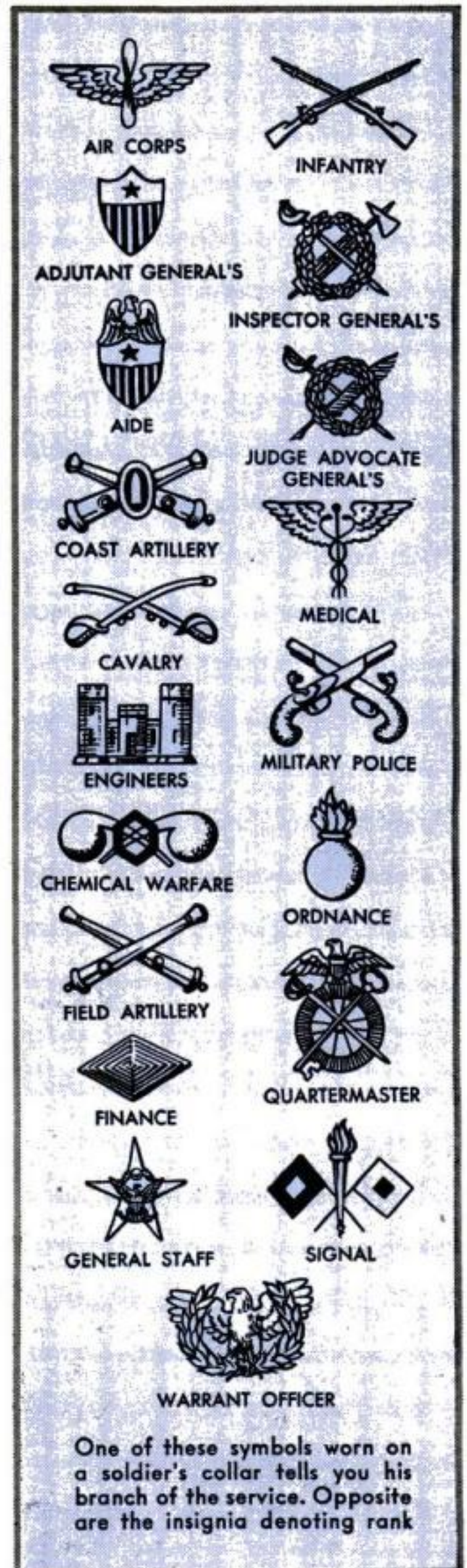
# What U.S. Army's Insignia Tell You About a Soldier



CAN you tell a colonel from a private by the insignia on his uniform? In the column at the left appear the insignia of every Army rank from a first-class private to a general. At the right are the insignia for identifying arms or branches in the U. S. Army. The combination of these will tell you what you want to know about any soldier.



*Commissioned officers wear insignia of rank on shoulder straps... non coms and privates on sleeves.*



One of these symbols worn on a soldier's collar tells you his branch of the service. Opposite are the insignia denoting rank



## Dog Leash on Spring Reel Plays Fido Like a Fish



With this spring-operated reel, there's no dragging leash to trip passers-by. A push button controls a lock to check the twelve-foot line at any point



A LEASH attached to a spring-operated reel is a new wrinkle for dog owners. Encased in a light but sturdy aluminum housing, the reel carries twelve feet of waterproofed leash strong enough to hold a great Dane yet light enough for use with a Pekinese. A hook forming part of the housing allows the owner to hold the device securely, while the dog is free to run for a distance of twelve feet. As he returns nearer to his owner, the spring reel winds up the leash cord to prevent it from becoming tangled. A button-controlled lock makes it easy to stop the dog at any time as he is running out the leash, and to keep him in hand.

## Individual Roasters "Home-Cook" Food for Restaurant

TO ASSURE his customers that "home-cooked" flavor, Ros Gammon, Pittsburgh restaurateur, has installed a battery of eighteen electric roaster ovens of the type designed especially for home use. If the patron desires it, waiters will wheel an individual roaster to his table, where he may watch his meal being cooked. Another service made possible by the roaster ovens is delivery of complete meals to private homes or hotel rooms. The entire meal is prepared in a single roaster and delivered, roaster and all, to the purchaser. By leaving the meal in the roaster, the food is kept piping hot until it is served.







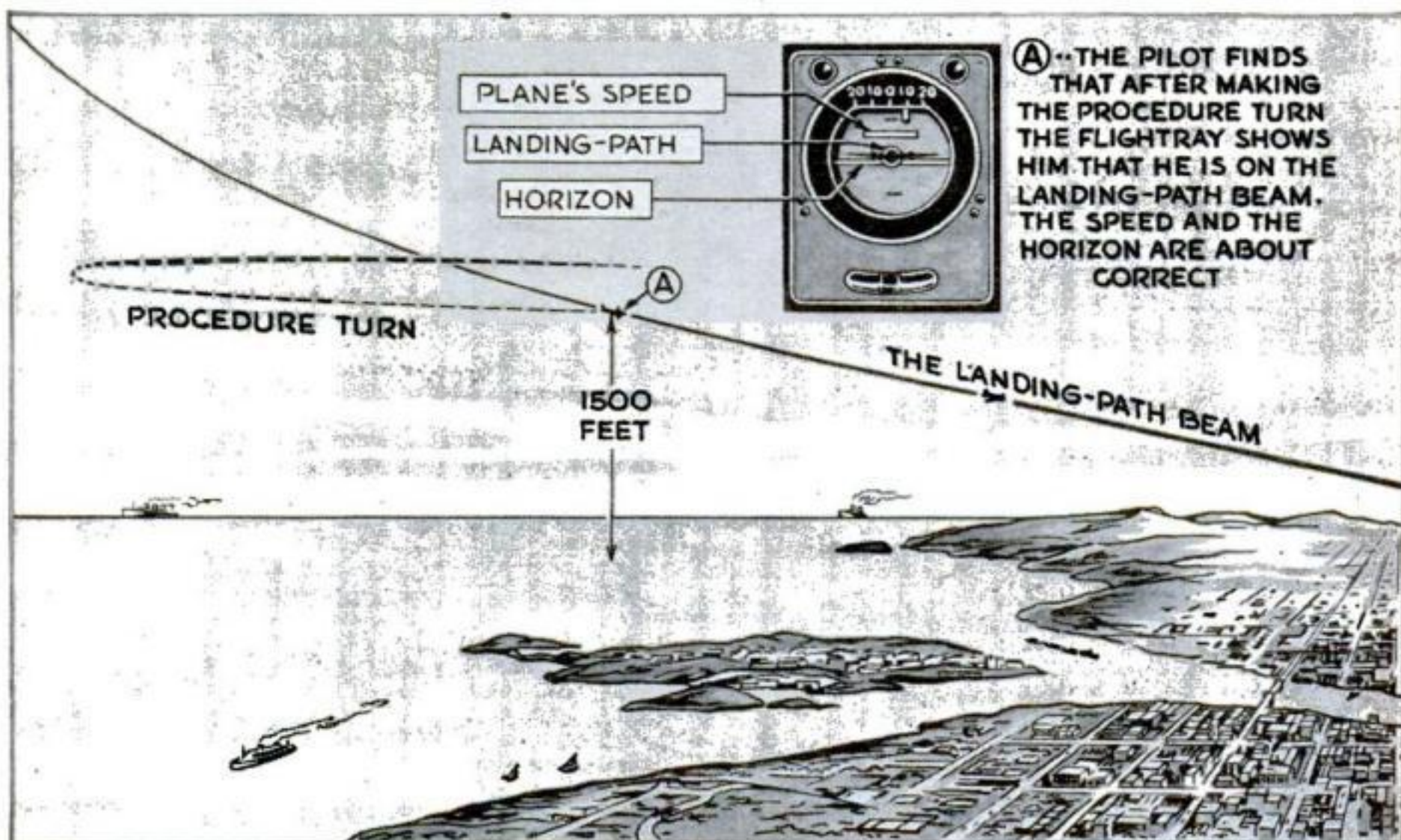
The Sperry "flying laboratory" used to test the Flightray

# RADIO EYE GUIDES

SIX essential airplane instruments are rolled into one by the Flightray, a remarkable device that enables pilots to take off, fly, and land in perfect safety with zero visibility. Tests conducted for several years by Sperry Gyroscope Company engineers have prepared for its debut as a standardized fitting for military and civil planes.

With dials multiplying upon flight panels of modern aircraft, and even spreading to walls and ceilings of the cockpits, a pilot's task in keeping track of them has become increasingly bewildering. Now the Flightray, a sort of radio eye, comes to the airman's aid by combining pictorially the readings of his gyro-horizon, directional gyro, altimeter, air-speed meter, radio compass, and radio landing meter.

Upon a circular glass screen with an airplane silhouette at its



How the Flightray guides a plane down the radio landing-path beam to a blind landing at an airport.



# PLANES TO SAFE LANDINGS

center, the pilot sees four luminous green symbols. A long horizontal line, his artificial horizon, shows by its movement whether the plane is climbing, dipping, or banking. A shorter horizontal line, rising and falling between two fixed marks, indicates the plane's air speed; if it reaches the lower mark, the plane is at the point of stalling. A vertical line at the top of the dial moves to left or right according to direction of travel. Meanwhile a green circle wanders about the dial; by keeping it in the center, the pilot stays on a landing-path radio beam when coming down at an airport. A purple lamp at the extreme upper left of the panel lights up as the pilot passes the outer marker beacon; an amber lamp at upper right, as he reaches the inner marker beacon at the field's edge. A conventional bank-and-turn indicator, at the base, completes the multipurpose panel.

A highly ingenious system based on movie principles combines the readings of master instruments on the cathode-ray screen of the Flightray. Actually the four green symbols appear one at

a time, but a rotating commutator picks them up in such rapid succession that they all seem to appear at once, with no visible flickering. Though unfamiliar at first, the resulting pattern becomes easy for an experienced observer to interpret at a glance.



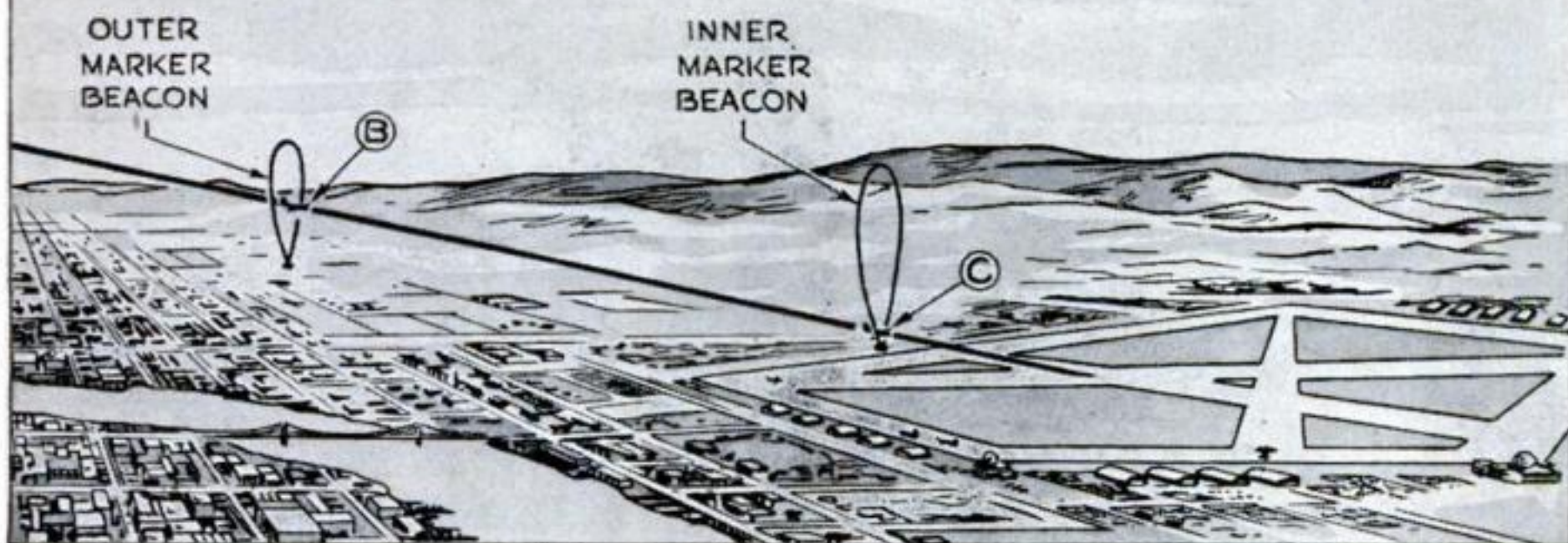
On the single dial indicated above, the pilot sees at a glance the combined readings of six instruments



**B**--THE PURPLE LIGHT ON THE FLIGHTRAY LIGHTS UP, SHOWING THE PILOT HE IS PASSING THE OUTER BEACON. HE IS ALSO ON THE PATH.



**C**--THE AMBER LIGHT ON THE FLIGHTRAY LIGHTS UP, SHOWING THE PILOT HE IS PASSING THE INNER MARKER BEACON. HE IS ON THE PATH AND IS DESCENDING PROPERLY. IN 20 SECONDS HIS WHEELS WILL BE ON THE GROUND



At each stage of the maneuver, the instrument holds the pilot on the path and indicates his progress





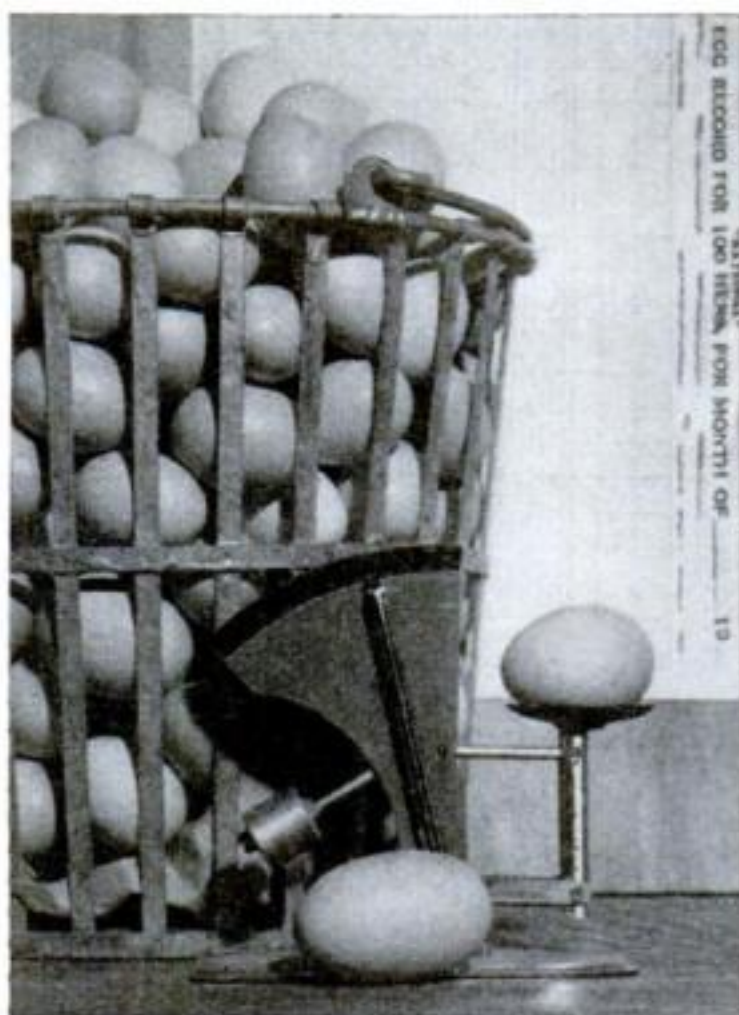
Two fried eggs from one shell. Housewives prize double-yolkers, but poultry breeders discourage their production



Floyd H. Moore with a pullet suspected of being too generous. Placed in a trap nest for observation, she has laid too many double-yolk eggs and will be sold. At right, a normal egg on the scale is contrasted with a two-timer

## Double-Yolk Eggs Are Sold By the Dozen

**D**DOUBLE-YOLK eggs are an unusual by-product of the poultry farm of Floyd H. Moore, near Lancaster, Pa. About thirty dozen of the freaks are produced every week by the 2,000 pullets housed in Moore's scientific five-story "hotel for hens." Prized by housewives because they pack a man-size breakfast in a single shell, they find a ready market and bring eight to ten cents more a dozen than ordinary eggs. However, Moore does not encourage the laying of double eggs, nor does he look with favor on a pullet which produces them too consistently, because his main business is selling chicks, and double eggs seldom if ever hatch live chicks. Any pullet is likely to lay one double-yolk egg in its lifetime, Moore says, but if he catches one of them doing it six or seven times, he disposes of the bird immediately, either destroying it or sending it to market.







## Minstrels from Mars? No, They're U. S. Army Airmen

CROWDED around in a huddle, the seven weird faces that appear in the unusual photograph reproduced above are those of U. S. Army Air Corps pilots attached to a bombing squadron at March Field, Riverside, Calif., wearing oxygen masks of the type

developed at the Mayo Clinic, Rochester, Minn. (P. S. M., Oct. '39, p. 101). The masks, which leave the mouth completely uncovered and therefore do not prevent the wearer from talking, are used to supply necessary oxygen during high-altitude flying.



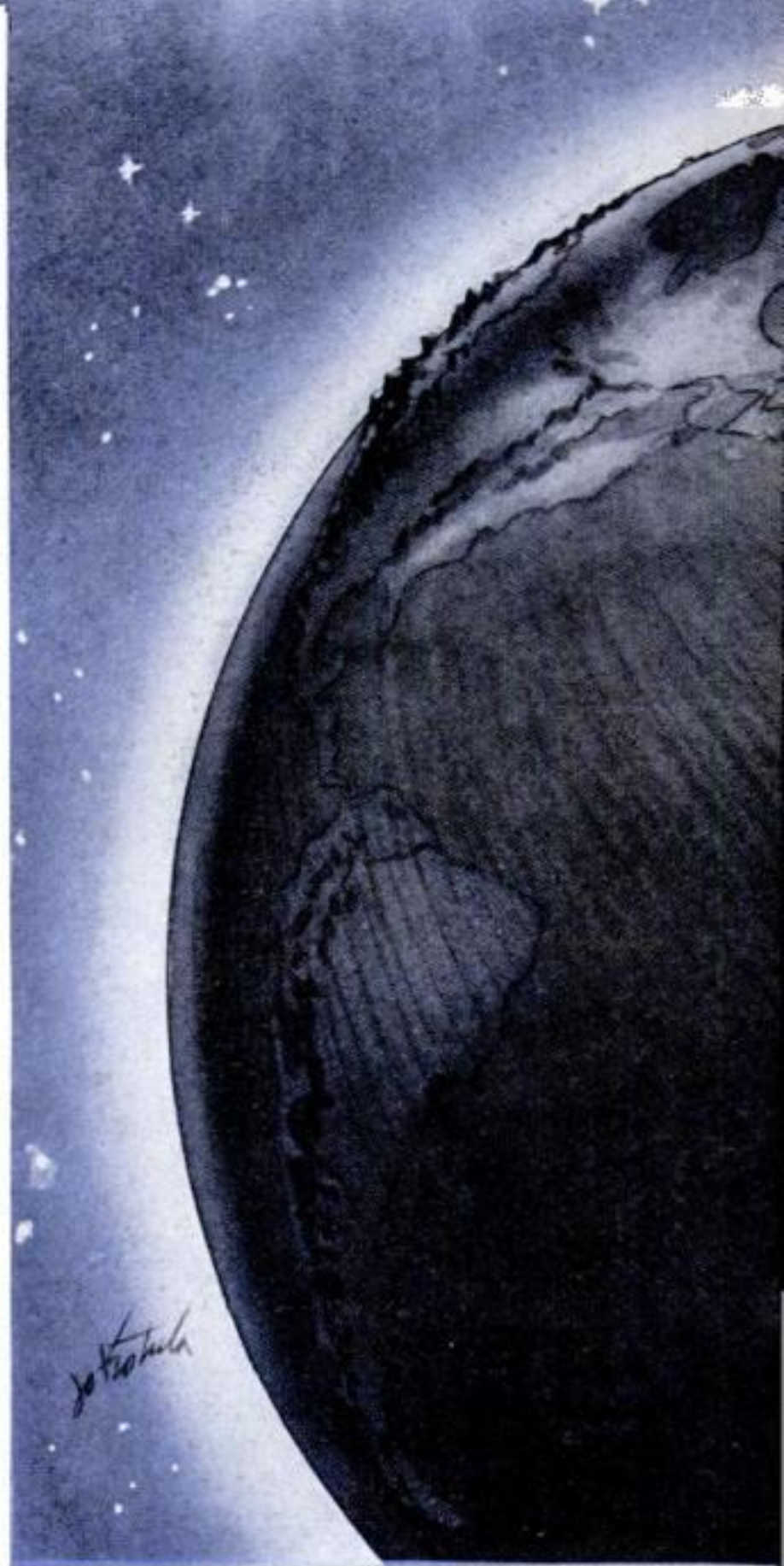


# *New Comet*

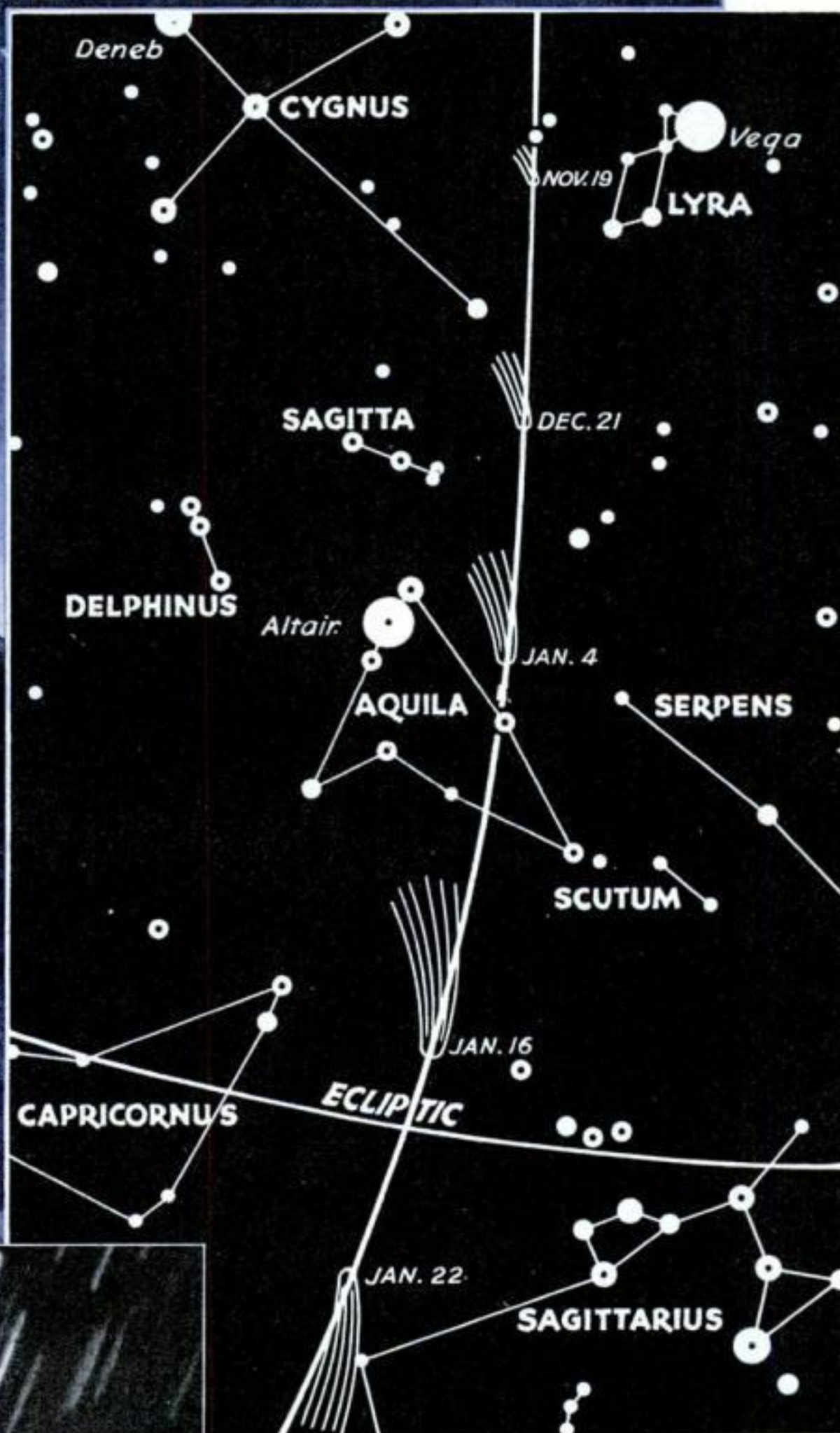
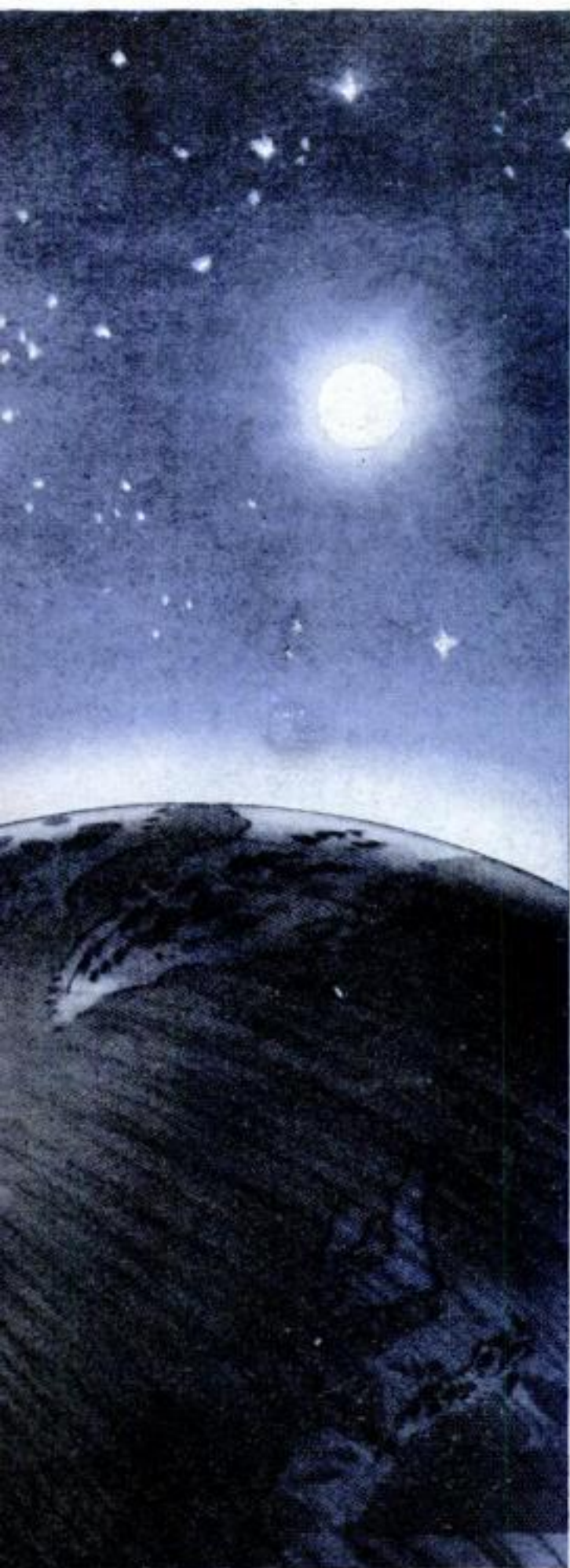
By **DR. DONALD H. MENZEL**

*Professor of Astrophysics, Harvard Observatory*

**A** NEWLY discovered comet that may rival in brightness the famous Halley's comet last seen in 1910, will be visible in the night sky during December and January. Spotted recently by Leland Cunningham, a graduate student at the Harvard Observatory, Comet Cunningham unfortunately comes very close to the sun and hence cannot be seen as it crosses the ecliptic or sun's path just after the middle of January. However, for a few weeks prior to that time, it should be clearly visible sailing down the Milky Way. The best time to observe the comet will be shortly after sunset, in the western sky, as it travels from north to south. Lay the chart reproduced on the opposite page on its side, with the top pointing toward the polestar. Then locate the comet by determining where it will be on that date in relation to the three first-magnitude stars, Deneb in the constellation of Cygnus, Vega in Lyra, and Altair in Aquila, all of which are close to or in the Milky Way. Although it can be seen with the naked eye, a small telescope, field glasses, or even opera glasses will be of great help in locating and observing the large hazy object, whose tail should be long and conspicuous, streaming out northeastward. Scientifically, Comet Cunningham is of great importance. Astronomers will follow it carefully as it approaches the earth, swings around the sun, and returns into the depths of space.







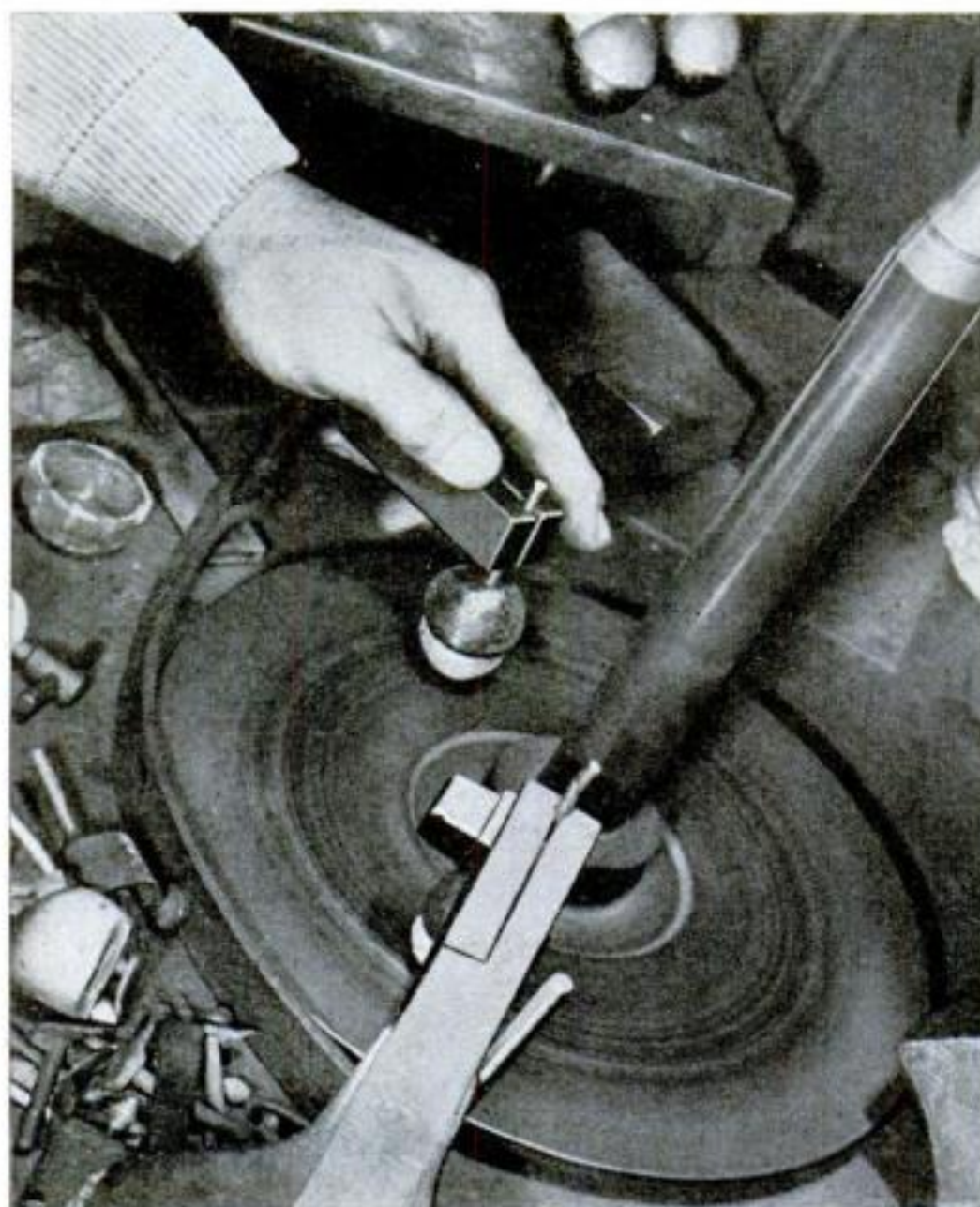
To locate Comet Cunningham, lay this chart on its side with the top pointing toward the polestar, and find its position on that date with reference to bright stars near-by

Astronomers believe that the new celestial visitor may rival in brilliance Halley's famous comet, which was last seen in 1910





Diamond cutting has changed little with time, but a powered spindle now turns the cut stone that marks a gem for splitting



Polishing is done on machines like those long used in Belgium and Holland. An abrasive disk grinds two stones at once

# Kings of Diamonds



**U**NKNOWN to most of the people in the United States, New York City has become the diamond-cutting center of the world. Before the German Army invaded the Low Countries, 24,000 cutters were employed in the homes and shops of Antwerp and Amsterdam. Now less than 400 cutters in New York comprise the largest remaining active group of men skilled in the art of creating a polished gem from a hunk of crystallized carbon.

Fewer than fifty cutters have escaped from Europe to continue their work here, so there is naturally a severe shortage of labor in the industry. It takes years to learn diamond cutting, and two weeks to make a finished jewel of only one carat.

In July, 1940, twelve times as many carats of uncut diamonds were imported by American firms as in any previous month. To meet the growing needs of American cutters, American manufacturers are now making diamond





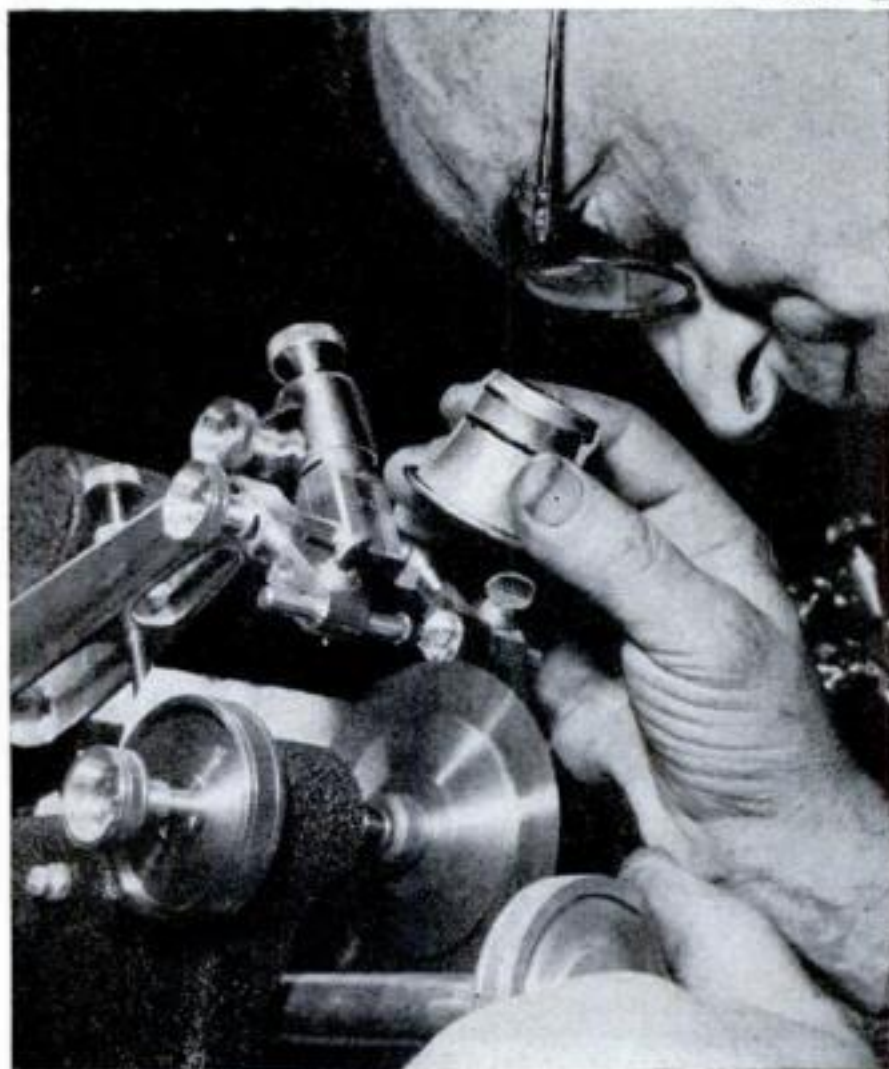
saws for the first time. Baumgold Brothers, the largest cutters in New York, with a staff of eighty men, have installed twenty-two of these American-made saws. The heart of the machine is a steel plate, four inches in diameter and .0035 of an inch thick, which spins at 3,500 r.p.m. The edge of this plate is coated with diamond dust and olive oil. Such a saw can cut through about one carat of diamond in eight hours.

American industry also has aided the diamond cutters by making it possible for them to keep their saws running continuously. Cutters have known for years that a diamond saw won't work in wet, muggy weather. But by air-conditioning their sawing room, Baumgold Brothers have licked the dampness and increased their sawing capacity by thirty percent.

While diamonds are prized for their beauty and rarity, only twenty-five percent of those mined become gems. The rest find their way into industry, where they are used, among other things, for truing grinding wheels of emery and carborundum, drawing wire, sawing and drilling stone, and metal etching. The demand for industrial diamonds is increasing rapidly as the defense program speeds up.



To split a diamond, the "cleaver" places a flat piece of steel in a nick marked in the stone, and taps it with a metal rod. The result is a clean cut along a line of cleavage

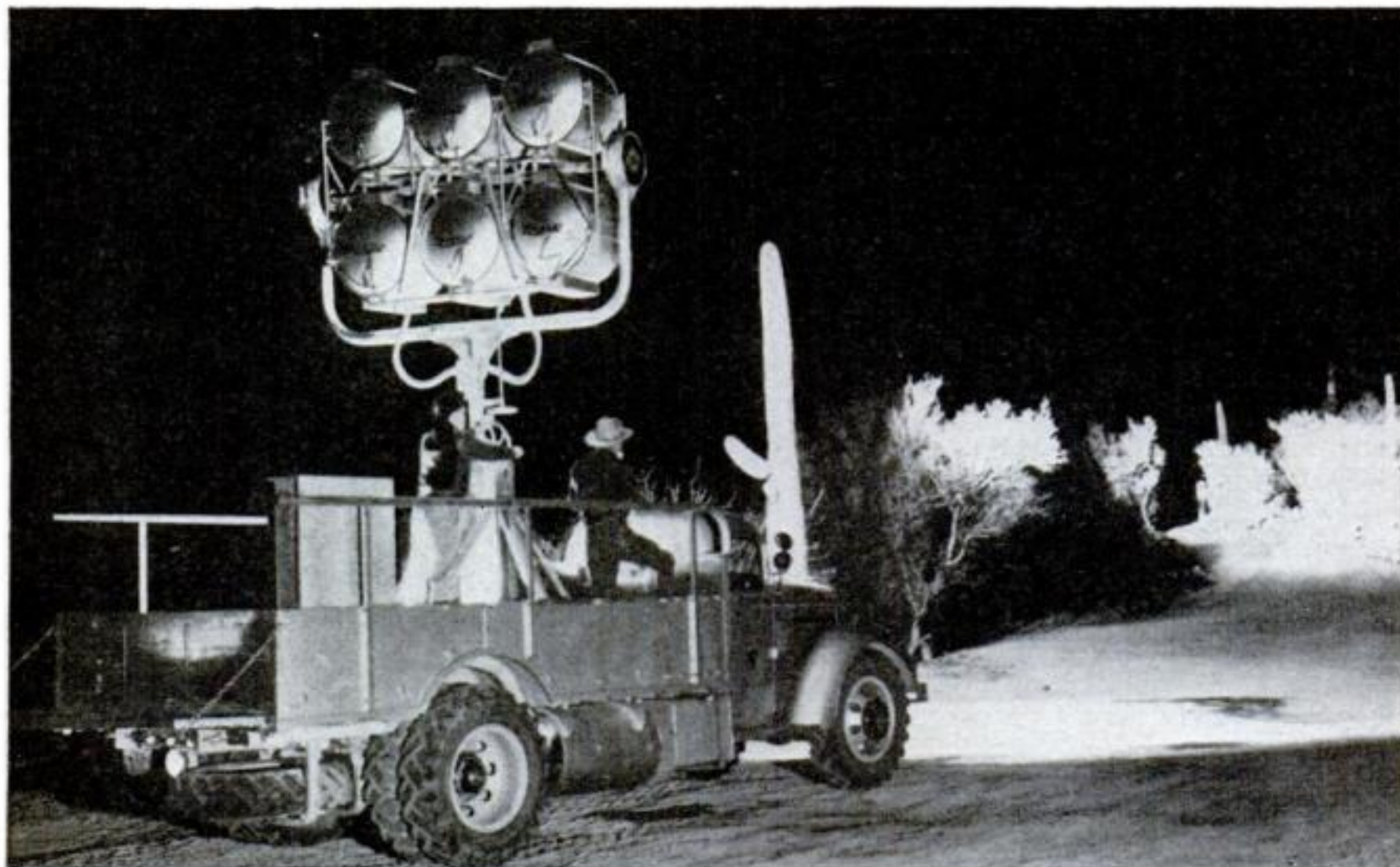


American manufacturers now make diamond saws. This steel disk is coated with diamond dust and oil



Examining finished stones. Four hundred cutters in New York have almost a monopoly of their craft





## Truck Carries Floodlights To Photograph Wildlife

TO BLIND or bewilder nocturnal birds and animals in the desert around Tucson, Ariz., long enough to photograph or capture them, an American Museum of Natural History expedition equipped a truck with a flood-lighting plant. Its battery of lights totaling 45,000 watts, operated on power generated by a 110-horsepower Diesel motor, provided enough light to allow color photographs to be made at night. Richard Archbold, who has led expeditions to Madagascar and New Guinea, headed the field trip. The party spent three months charting the wild life of the region. At the left is an indignant owl, momentarily baffled by the brilliant beams of the lights.



What an owl looks like when it's hooting mad and caught in the glare of huge lights on the truck

## Bottle Sprays Solution for Treating Burns

BURNS can be treated easily and quickly by spraying the injured part with a solution contained in a handy bottle. All that is necessary is to point the nozzle at the burned area and press a lever attached to the cap. Volatile ingredients in the solution produce the pressure necessary to eject it from the bottle.



How soothing liquid may be sprayed on a burn to relieve pain





Leopold Stokowski on the podium of a sound stage in Hollywood during the filming of the visual part of the Walt Disney feature "Fantasia"



# Mickey Mouse Goes Classical

By ANDREW R. BOONE

**M**OVING sound has been added to moving pictures to bring greater realism to the screen. Accompanying Walt Disney's newest Technicolor creation, "Fantasia," in which Mickey Mouse and a host of new companions perform to the rhythms of classical music, this latest Hollywood invention made its first public appearance a few weeks ago at the Broadway Theater in New York.

Moving sound is literally that. Four circuits using sixty loudspeakers make it possible to chase music right around an

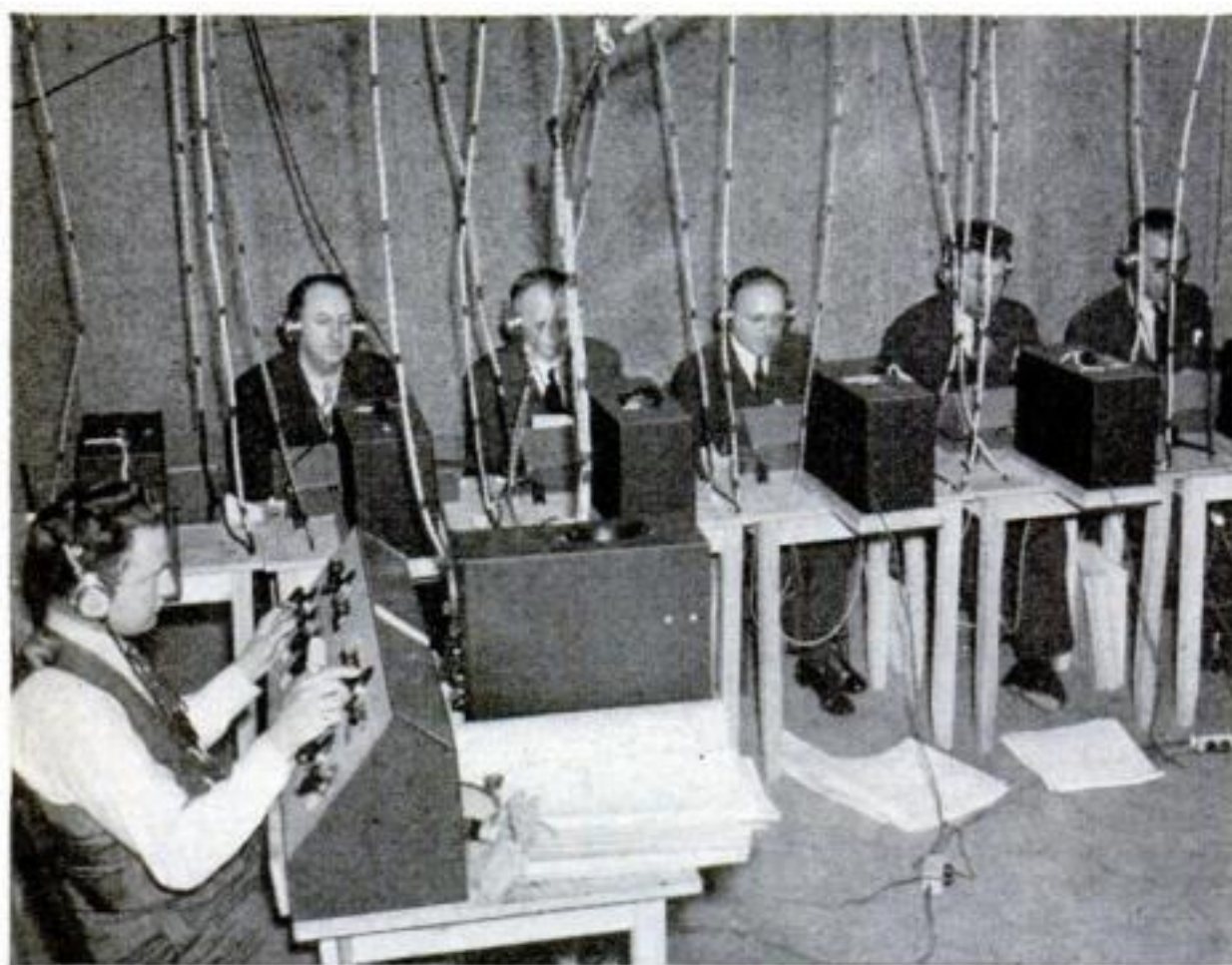
audience, out of the screen and back into it, or make notes die away into infinity overhead. The sound equipment alone fills thirty-five packing cases. For that reason "Fantasia" will be screened only in selected metropolitan theaters where the speaker systems can be installed.

Two years of painstaking work by Disney, R.C.A. engineers, and 1,000 Disney assistants went into "Fantasia," which is really a pictorial interpretation of seven great compositions. The music is by the Philadelphia Symphony Orchestra, under





Disney explaining the story to Stokowski and to Deems Taylor, the music critic, who also helped Mickey Mouse to crash the realm of the classics



In the basement of the Philadelphia Academy of Music, technicians control the recording of music from different sections of the orchestra

the baton of Leopold Stokowski. Deems Taylor, music critic and composer, aided in making the production.

Behind "Fantasia" lies Walt Disney's desire to always give the public something new and better than what they have known in the past.

"We know," he said recently, "that music emerging from one speaker behind the screen sounds thin, tinkly, and strainy. We wanted to reproduce such beautiful master-

pieces as Schubert's 'Ave Maria,' and Beethoven's Sixth Symphony so that audiences would feel as though they were standing on the podium with Stokowski."

To achieve this effect, he knew that means must be found to spread sound throughout the theater, that "point sources" must be concealed from the ear. The sound recordings must be such that each and every instrument or voice would be heard clearly and distinctly in its proper proportion to the whole orchestral effect.

The recording alone for "Fantasia" took almost eighteen months. Approximately 3,000,000 feet of sound track from individual takes, prints, and remakes were condensed into the final 10,778-foot, four-track negative.

Neither Disney nor the engineers knew just where the experiment would lead when the 110 members of the orchestra first took their places on the stage of the Philadelphia Academy of Music early in April, 1939. Thirty-three microphones faced the musicians. From them nine channels carried the music to nine recorders set up in the basement of the building. Seven channels transmitted sounds from individual groups of instruments such as the wood winds and the violins. The eighth caught the com-

plete orchestration, while the ninth carried the beat of a telegraph instrument which later enabled the animators in Hollywood to fit the action of "Fantasia" to the tempo of the music.

Seven weeks Stokowski and the orchestra labored. All that time a second director faced the recording instruments, guiding the recording on film of each passage. From a duplicate score he brought choirs in and out, stepped up solos. Engineers tuned



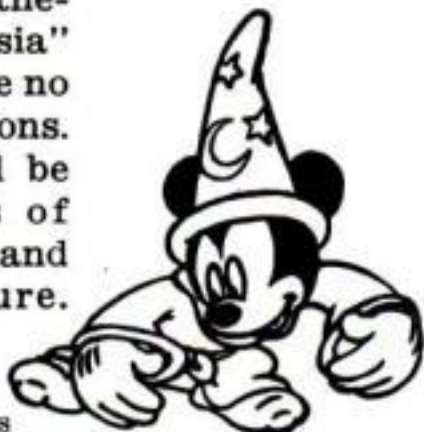
volume controls, guided by oscilloscopes which told them just how much sound was coming through their machines.

Exactly 483,000 feet of sound track were recorded in forty-two days. Cans of film were shipped by air to Hollywood for processing. After that retakes were made where necessary to obtain exactly the desired tonal combinations of choirs, soloists, and instruments.

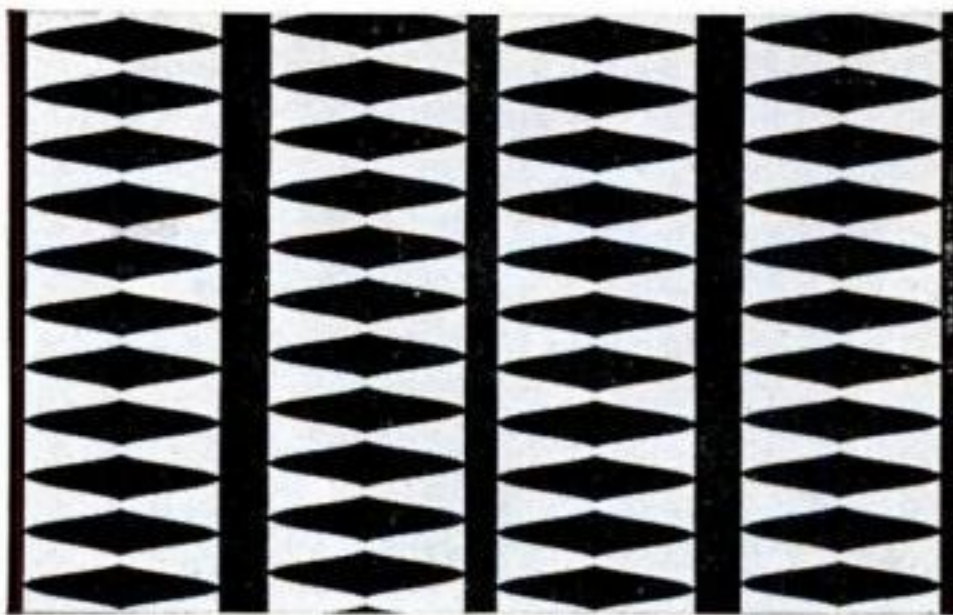
Then came the problem of mixing these sound tracks into one realistic whole. First the engineers tried multiple speakers fed by a single sound-transmission system. That spread the sound over a wide area, but when the characters spoke, the synchronization of words and lip movements was lost.

There were further experiments before the producers were satisfied. The solution was finally found in combining the nine tracks into four; three for "entertainment sounds," such as voices, music, and special effects, and the fourth for a control frequency governing the volume of the other three.

Operators in the projection booths of theaters where "Fantasia" is presented will face no unusual complications. Their problems will be the routine ones of threading the film and focusing the picture.



© WALT DISNEY PRODUCTIONS



This is how a sustained note looks on the four film tracks that create the novel effect of "moving sound"



To synchronize the recordings of three program tracks, dials on the recorders were linked with endless chains



Technicians at a re-recording console merge the sounds from the seven tracks made at Philadelphia



# Inventors Begin Search FOR A Secret Weapon

NATIONAL COUNCIL HUNTS  
NEW IDEAS FOR DEFENSE



J. Robert Fish demonstrating an anti-aircraft rocket which is said to find its target by sound. At the left is W. B. Hale with his "mystery gun" that shoots balls by compressed air



By MYRON M. STEARNS

**T**HE greatest American inventors alive today are organizing a country-wide search for a secret weapon.

It may come from a tiny workshop in a country lean-to. It may come from the benches of a great research laboratory. It may be the brain child of an already-famous scientist, or the ugly duckling of an unknown inventor. It may be the result of long, painstaking experiment, or the result of an accident. It may concern a rocket ship that will change all aviation—or a cheap, light substitute for lead that can be as readily cast and as easily bent.

To find that priceless idea—to mobilize American genius in the development of all ideas that will make this country a more formidable adversary—the United States

Government has created the National Inventors' Council. Its business is to stimulate, find, and appraise suggestions, ideas, and devices that may be useful in time of war.

To a greater extent than ever before, war has become a contest of inventors. Fighting in three dimensions, foreshadowed twenty-five years ago by the first war planes and the submarine blockade, has now become an accepted fact; it is still so new that nobody yet knows what developments may change it completely. A single idea may bring victory to one side or another.

That is where the National Inventors' Council comes in. American inventive brains are recognized as the best in the world. Americans were the first to fly, first to build seagoing submarines, first to put armor on warships and change the navies of the world, first to put armor on automobiles and create modern tanks, first to "fix" nitrogen, first in mass-production methods.

Every inventor in this country, amateur or professional, is being urged to send in to the Inventors' Council whatever designs he



has been experimenting with, whatever devices he has already worked out, that may be valuable from the standpoint of defense. One may have found a way to keep metal from heating rapidly, that can be used in the manufacture of rifle barrels. Possibly another knows of some substitute for gelatin, that will help give muscular strength in an emergency. The National Inventors' Council, at the Chamber of Commerce Building, Washington, D. C., can make them available for the whole country.

The N.I.C. will not pay for ideas, nor have anything to do with their being patented. It has no connection with the United States Patent Office. Nor will it give advice as to whether or not an idea should be patented; that is the sender's business. But suggestions or devices found useful will be turned over to the Army or Navy, or whatever government department may decide to use them, and will then be negotiated or paid for in accordance with the regular custom and rate of that particular department.

No suggestions will be considered that do not relate to defense. All suggestions must be in writing, in English, each one separate, supplemented by drawings if necessary. Senders are advised to keep duplicates of their suggestions, signed and dated, preferably in the presence of witnesses. Models, and materials of all kinds such as chemical substances, are to be forwarded to the Council only if requested.

A certain amount of data is also necessary: Sender's name and address. Is the suggestion in use, or merely an idea requiring further development? Has it been patented? Has a patent been applied for? Is the sender the sole inventor? Has he

assigned any rights? Is he acting as owner or agent? Has the idea been divulged to any foreign government?

Nothing should be sent in that has already been submitted to any other government department.

Ideas that state only objectives, instead of a means of accomplishing something, are not wanted. "A bomb that will follow an airplane around until it hits it" is no use to anybody unless the sender tells how it can be done.

Also, ideas concerning things of which the sender is ignorant will, obviously, be worthless. A device that works all right on a table might be useless on the wave-swept deck of a battleship. Creators of ideas outside of their own lines of knowledge are advised to discuss their inventions with an expert in that field, whom they can trust, before submitting them.







There is no time to be lost. Production of next year's airplanes is already under way;

From the drawing boards of the nation's inventors, defense suggestions will flow to the Washington offices of the National Inventors' Council, some of whose members are seen below at a meeting in the Department of Commerce





## TWO DOZEN DEFENSE NEEDS THAT INVENTORS MAY SUPPLY

- 1 A cement for fastening rubber to metal.
- 2 A finish to which ice will not stick, for use on planes and windshields. 
- 3 A means of dispelling fogs over airports to permit operations in any weather.
-  4 Spark plugs with points which will neither burn under full-load engine operation, nor foul at idling speeds.
- 5 Methods of making building materials, such as lumber and plywood, non-inflammable.
- 6 Lighter-weight batteries for portable radios to make them still more portable.
- 7 Temperature indicators for use in molten steel in furnaces and ladles. 
- 8 Storage batteries without a corrosive electrolyte, which would require no attention.
- 9 A device to use waste heat energy in airplane exhaust gases for jet propulsion.
- 10 Tools for inexpensive welding of structural parts "on location." 
- 11 Instruments for more adequately measuring the effectiveness of various lubricants.
- 12 A fuel system for aircraft that will compensate for the drop in pressure at high altitudes and avoid vapor locks.
- 13 A form of cast iron that will bend under stress instead of breaking.
- 14 Stainless steel that is capable of resisting a pressure of 150,000 pounds per square inch without suffering deformation.
- 15 Heat and wear-resisting steel bars that machine easily to make gun barrels.
- 16 An acid and heat-resisting alloy which will cast readily and machine easily.
- 17 A method of producing full-color prints from original transparencies in a single operation. 
- 18 Metal alloys that will resist pitting by electrical arcs, for switches.
- 19 Soldering flux that will not cause corrosion of soldered parts in service.
- 20 A solder that will work on aluminum as well as lead solder now does on tin.
- 21 Boilers which will not accumulate slag.
- 22 Durable paint for ship's bottoms.
- 23 Photographic enlarging paper to reproduce accurately tones in negatives.
- 24 Material similar to Formica or Mica, which will not absorb moisture, to make internal pump parts. 



ORVILLE WRIGHT, who, with his brother Wilbur, built the first successful flying machine, is a member of the Council. His invention has revolutionized the science of war



FRED MORRELL ZEDER, vice president of the Chrysler Corporation. A veteran automobile man, he was chief engineer for the Studebaker Corporation before joining Chrysler. Grew up with the automotive industry



WILLIAM D. COOLIDGE, director of General Electric Research Laboratories. A physical chemist, he invented and applied ductile tungsten. Another achievement is the invention of an improved X-ray tube



ideas that may be submitted now for improved planes, tanks, listening devices, explosives, guns or submarines cannot get into production for months or years ahead. The idea of protecting automobiles with armor and mounting guns on them was already seven years old in 1914, but the first tanks did not make their appearance in actual battle until near the close of the war. Before the armistice in 1918, devices for the radio control of torpedoes and even aerial bombs were being experimented with, but they're not perfected yet.

A lot of people have realized the value of getting American genius to work in these days of world upheaval. Among those who discussed the matter last summer were Lawrence Langner, prominent New York patent attorney, and his friend Thomas Midgley, inventor of ethyl gasoline. They went to Conway P. Coe, United States Commissioner of Patents. Their plan sounded good. The three of them went to Harry Hopkins, then Secretary of Commerce, and with the President's approval the Inventors' Council was hatched. Men of outstanding ability and character, whose names and achievements alone inspire confidence, were called in. Charles F. Kettering



**CHARLES F. KETTERING** world-famous inventor and president of General Motors Research Corporation, is chairman of the council

accepted an appointment as Chairman. Commissioner Coe, Langner, Dr. Midgley, Dr. Fin Sparre, Orville Wright, Dr. William D. Coolidge, Dean Frederick Feiker, George Baekeland, Fred M. Zeder, Watson Davis, and Dean Webster N. Jones of Carnegie Tech agreed to serve with him.

These dollar-a-year top-notchers are not merely a "front." Each is the head of a technical subcommittee in the field of his own special knowledge. That means a lot of work.

Two high-ranking officers are also serving with the council: Rear Admiral Harold C. Bowen, representing the Navy, and for the War Department, Major General J. O. Mauborgne, Chief Signal Officer of the Army since 1937.

If the danger of our going to war is finally averted, or if we go to war and come out all right on the other side, the Inventors' Council may become a tremendous force for the advancement of civilization. Just as nitrogen can be used either for explosives or for fertilizer, nearly all devices suitable for war can be doubly effective for peace. Instead of using mosquito planes for dog-fights, we may be hopping into them, as we do into autos today, to visit the neighbors.



**CONWAY P. COE**, United States Commissioner of Patents, brings to the Council a wide knowledge of inventions and inventors. In spite of his membership, the Council has no connection with the Patent Office

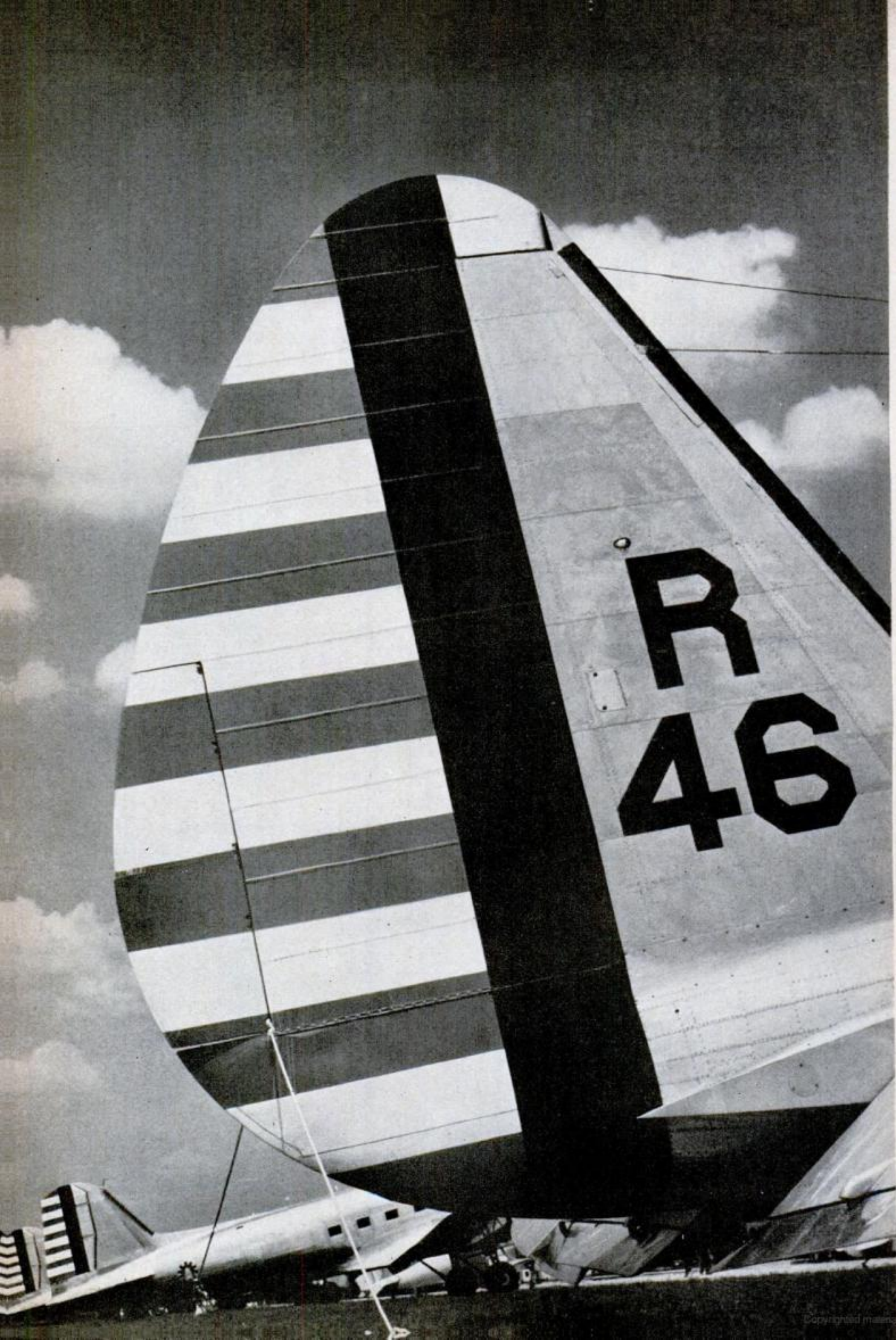


**LAWRENCE LANGNER**, patent attorney. Author of many technical articles on patent laws and their applications. He is also interested in the theater and is the author of the comedy "Suzanna and the Elders"



**FREDERICK M. FEIKER**, dean of the George Washington University School of Engineering. For three years editor of "Electrical World." He was Assistant Secretary of Commerce in the Hoover Administration







# What Is the Outlook for Aviation in 1941?

By C. B. Allen

**P**RESENT indications point to 1941 as a boom year in American aviation. On both the military and civil aeronautical fronts, prospects could scarcely be brighter—thanks to factories glutted with British war orders and American national-defense contracts and to the Civil Aeronautics Administration's pilot-training program in the universities and colleges.

The warplane building program is scheduled to go on at ever-increasing tempo until the second quarter of 1942. By that time, the National Defense Advisory Commission estimates, the industry will have produced (since July 1, 1940) some 19,000 aircraft for our own Army and Navy, plus 14,000 for the Royal Air Force; simultaneously, it will have built up its production capacity to the point where it can turn out fighting planes at the rate of 50,000 a year.

Whether there will be a continuing market for any such production, at home or abroad, is a question the experts seem willing to leave unanswered until 1942. Actually, the combined aircraft requirements of the Army and Navy, as presently conceived for Western Hemisphere defense purposes, is less than half the 50,000 airplanes envisaged by President Roosevelt in his "total defense" message last May.

The C.A.A. program lays claim to no military significance beyond that of creating a reservoir of air-minded

youth, trained in the rudiments of flying, from which the Army and Navy can draw candidates for their specialized training. This is no longer a "civilian theory"; it already has been transformed by the demand for military pilots into an everyday fact and one which seems to be working to the great satisfaction of the two services. Likewise, the Army appears to be well pleased with its now well-established system of contracting with civilian flying schools to give the majority of its air cadets their primary training.

This experiment, and the far more comprehensive one of the C.A.A. in carrying out its pilot training program through the existing facilities of civil aviation—the struggling flying-service operators on thousands of airports all over the country—have been a tremendous boon to the industry. What is more, they may be the means of its salvation in the inevitable let-down days ahead when the present "emergency" passes, when the expanding aircraft factories of today come to an end of their war orders and a tapering-off of their defense contracts. Perhaps, when that time arrives, the thousands of young men and women whom the C.A.A. has taught to fly will constitute such a market for civil aircraft that a thriving industry can be kept alive without the stimulus of abnormal military buying.

## Turning Out the Planes

By Arthur Grahame

**"W**E HAVE big orders and we are getting the materials we need to fill them. We are expanding our plant, installing new machines, training new workers. All the other airplane manufacturers are doing the same thing. Mass production will become a reality just as soon as these new

← Here are some of Uncle Sam's new bombers. Aircraft factories are humming to produce 19,000 fighting planes for our own Army and Navy, and 14,000 for Britain, by 1942

facilities can be put to work. And with mass production we'll get the job assigned us done on time."

That's the way the aircraft-production situation looks to an official of the Glenn L. Martin factory, Baltimore, Md.—a man who is on the industry's firing line in its battle against time to build up our inadequate air defenses. How does it look in Washington, G.H.Q. of the colossal defense program?

Right now the country's aviation experts are devoting all their time to turning out the 33,000 bombers, dive bombers, and pursuit ships—19,000 for our own Army and Navy and 14,000 for Great Britain—which they have estimated American factories can produce by April 1, 1942. (Continued)





3d Torpedo Squadron (Navy)



1st Observation Squadron (Navy)



6th Scouting Squadron (Navy)



96th Bombardment Squadron (Army)



99th Bombardment Squadron (Army)

Plant expansion, financed wholly or in part, directly or indirectly by the Government on terms which protect the manufacturers against loss when the present emergency is over, is going ahead. The Curtiss-Wright Corporation is building new plants near Columbus and Cincinnati and is enlarging its Buffalo, St. Louis, and Paterson, N. J., factories. Similar expansion has been accomplished and is still under way at United Aircraft Corporation's Pratt & Whitney engine and Hamilton Standard propeller divisions, in East Hartford, Conn., and at its Vought-Sikorsky airplane division at Bridgeport, Conn. The Martin company is increasing its floor space from 1,250,000 square feet to almost 4,000,000. North American Aviation is supplementing its Los Angeles plant with a new one in Dallas. Douglas, Boeing, Consolidated, Lockheed, Vultee and all the other companies are making planes for the Army and Navy.

Building aircraft engines is a more complicated job than turning out the

airplanes themselves, and engine production cannot be increased with the same rapidity as that of aircraft. Already the public has seen the spectacle of combat planes coming off the production line days and weeks ahead of the engines to be installed in them; of motorless Curtiss P-40 pursuit ships collecting under circus tents and other temporary shelter at Buffalo, waiting for their Allison engines; of Boeing flying fortresses cluttering up the airport at Seattle waiting for Wright Cyclone motors, or being stripped of their power plants after flying to an Army field so that the engines could be taken back to the factory and installed in a succeeding bomber.

Seen in flight, the modern military airplane has a look of sleek simplicity, yet it is one of the most complicated weapons man has ever evolved. Its 14,000-odd parts come from several hundred different sources of supply; the knowledge and skill of scores of sciences and crafts go into it.

In the Martin plant, after the design of a new plane is approved, it is

## These Army and Navy fighters, bombers, dive bombers and



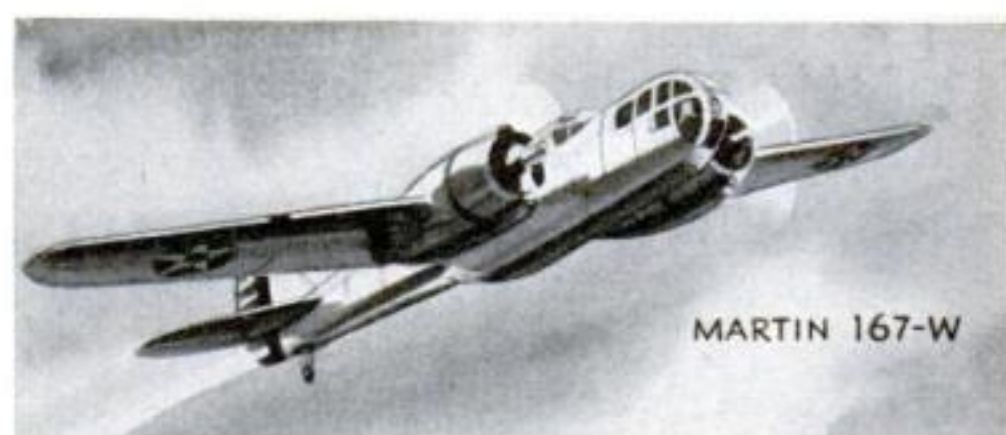
CURTISS P-40



LOCKHEED XP-38



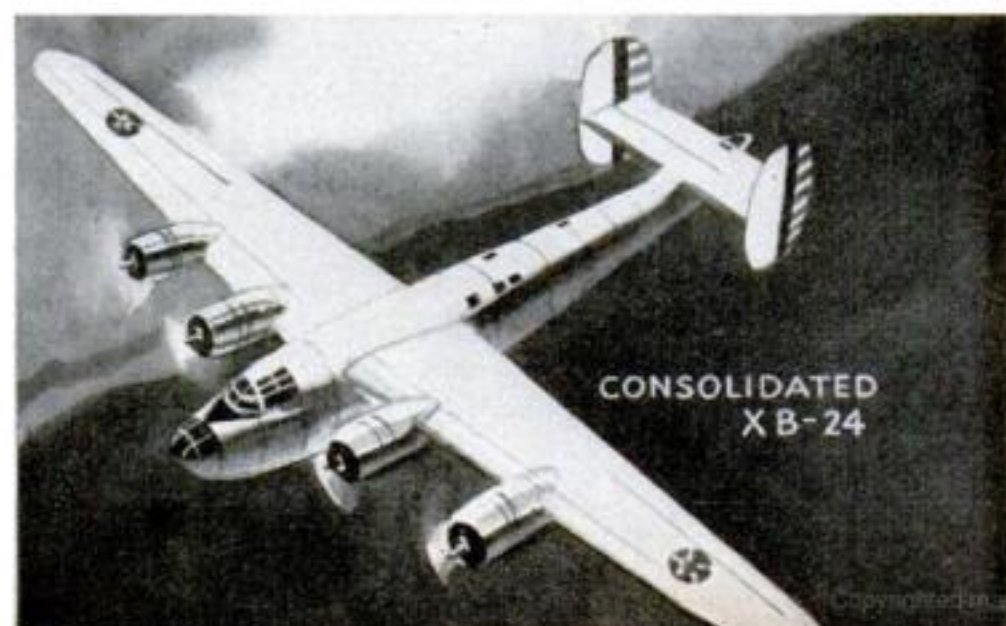
BELL AIRACOBRA P-39



MARTIN 167-W



BOEING B-17



CONSOLIDATED XB-24



drawn out, full size, on coated aluminum-alloy sheets. When every detail is complete, the sheets are photographed by a huge camera of special design, which is later used as a projector to reproduce the drawings, full size or to any desired scale, on any material.

Tool-design engineers decide on the machine tools and dies needed to make the plane's many parts. Dozens of special machines cut and bend metal into the shapes called for by the drawings. A metal-stretching press forms the whole belly of a bomber fuselage over a wooden pattern in a single quick operation—it would take two men six hours to do that job by old, bumping hammer-and-file methods. A big router shapes out a dozen sheets of duralumin at a time.

Airplane-factory assembly lines do not move in the continuous fashion of automobile assembly lines, but rather by stages. The standards of workmanship are too high and the stake of human life too great for the speed of automobile production.

As parts move from stage to stage on the production line they are joined together in sub-assemblies until at last they become wings or tails or nose sections. For the sake of accessibility, the whole front end of a bomber fuselage is built in halves, with controls and other interior fittings installed, and these halves are then riveted together. As the various sections of the plane near completion, they converge in a final assembly line and are joined together as a complete ship. The engines are then installed, fuel and oil lines and electrical wiring are hooked up, controls are connected, and the airplane is ready for flight.

The job of supplying the United States and its friends with 3,000 planes a month is a prodigious one, yet "Big Bill" Knudsen, the Defense Commission's production coordinator, believes that it can be done. He has inspired the confidence of the entire aviation industry by cutting red tape and eliminating lost motion, until now even the industry's professional pessimists see light ahead.



2d Wing (Army)



8th Pursuit Group (Army)



30th Bombardment Squadron (Army)



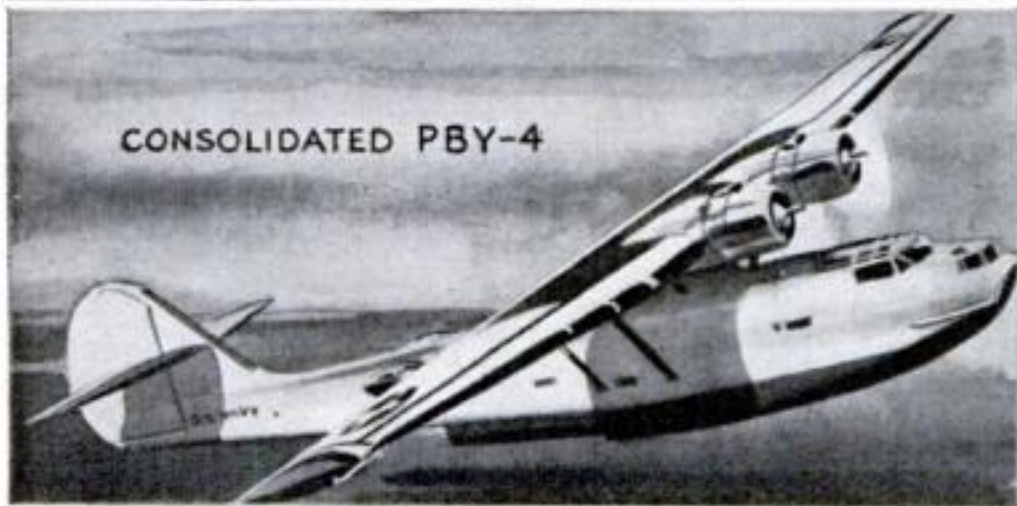
3d Utility Squadron (Navy)



5th Fighting Squadron (Navy)

## patrol planes are the latest additions to the U. S. air forces

CONSOLIDATED PBY-4



DOUGLAS  
DIVE  
BOMBER  
BT-1



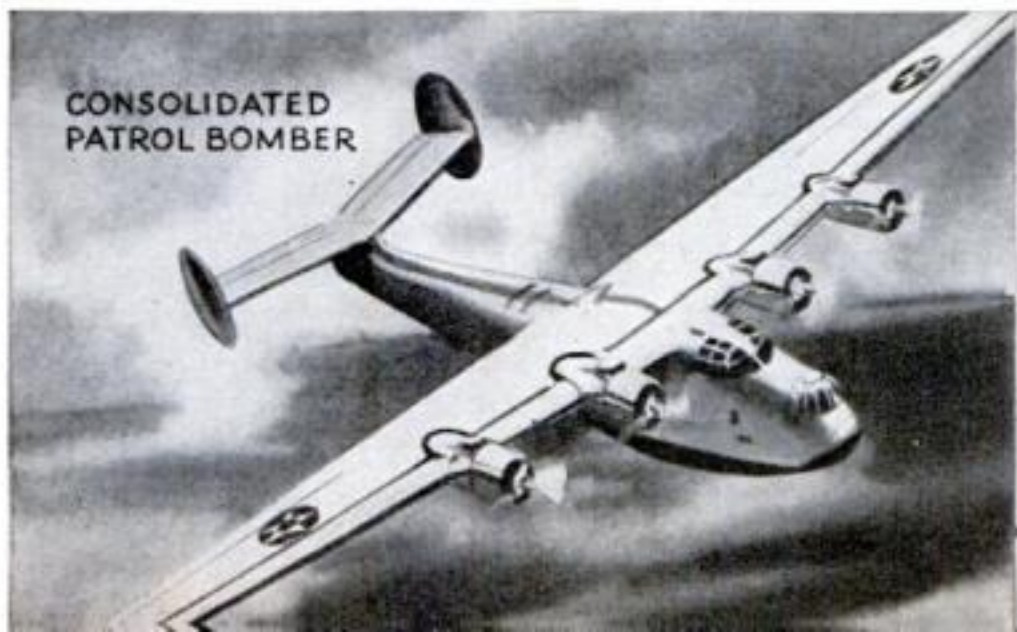
GRUMMAN  
SKYROCKET



BREWSTER FIGHTER



CONSOLIDATED  
PATROL BOMBER



MARTIN XPBM-1





# Canada Rallies Her Cat Men

NORTH WOODS TRACTOR DRIVERS SUMMONED TO RUN WAR TANKS



From the sled trains of the canoe country come the men for the Dominion's growing tank brigades

ing machinery and supplies to the new gold mines of the northern canoe country.

For this kind of mushing, which in recent years has conquered the swampy wilderness for heavy traffic, a man has got to be tough. But especially he's got to be good. That's why

he's sure to make a real tank soldier.

The far north's new breed of musher is called a cat-skinner. Up around God's Lake and Hudson Bay there aren't so many cat-skinners this winter. They've been joining the Canadian Army in droves, and as soon as they can get a proper rig of machinery they are figuring on starting for Berlin. After all, a tank is nothing but an over-

By HICKMAN POWELL

**F**IFTY degrees below zero, a blizzard blowing, and 200 miles to go. Over frozen muskeg bogs, down creek beds, and up through the bush over rugged moraines go the drivers of the tractor trains, all through the wild Canadian winter, freight-



grown, armored cat—with some teeth in it.

At his peacetime job, the cat-skinner rides the cab of a six-ton Caterpillar tractor over trails marked by poles in the drifted snow, with six sleds and a caboose behind and maybe fifty tons of precious freight. On his cat he carries a spare radiator and six barrels of gas. He uses fuel oil for anti-freeze and he keeps his engine running for five or six days at a stretch. If it breaks down on him, he rigs a tent over his cat, installs a stove, takes a chew of tobacco and a monkey wrench, and fixes things right on the spot. When he starts out with a cat train, he gets there and he brings it back.

You'll find these north-country men today in a sandy wilderness of tar-paper shacks called Camp Borden, up between Lake Simcoe and Georgian Bay, north of Toronto—tinkering with those 200 World War tanks which the U. S. Army sent to Canada a few weeks ago.

With them are cat-skippers from the western construction crews, drag-line men, clamshell men, bulldozer men. And hundreds of boys from the farms of Manitoba and Saskatchewan, who know their gas engines and Diesels too. If a lad is tractoring a section of wheat land twenty miles from the railroad, he can't call the garage when something goes wrong. And when that lad goes to town, he drives his own jalopy.

One look at those old tanks we sent to Canada would give Hitler a belly laugh, but another look at the men who are handling them would tone it down. Just let the R. A. F. and London hold out long enough for the tank factories to get going, and the Panzer divisions will have something to tangle with.

Take the Fort Garry Horse, for instance. That's a cavalry regiment from Manitoba, named for the old frontier post which became Winnipeg. In the last war it dashed behind the lines and put a German field battery out of action,

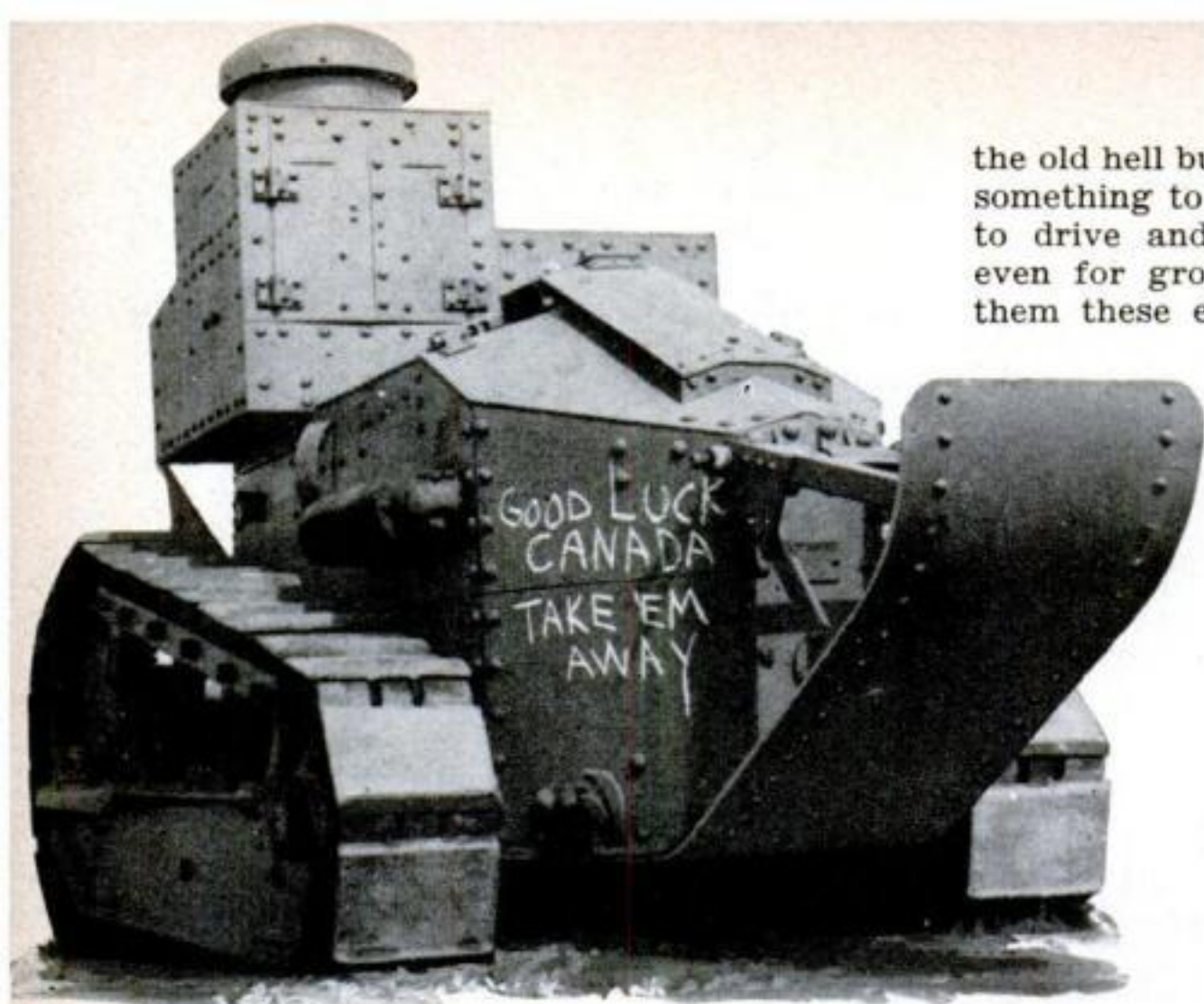
with a mounted charge against withering machine-gun fire, one of the great cavalry exploits of modern war. It was a sad, sentimental day for Col. Samuel J. Cox and his older officers when, in September 1939, the Fort Garry Horse bowed to the inevitable, mobilized as a mechanized outfit, and recruited up to war strength with tractor men, garage mechanics, and cat-skippers. But it was a sadder winter when men who had volunteered for mechanized duty found that they had no machinery to work with. By the end of the summer (spent guarding German prisoners captured in the mechanized blitzkrieg abroad) these men were so machinery-hungry that they'd have started picking their wrist watches apart if something hadn't happened.

That something was the sale of the old American tanks, which made it possible to bring together the Fort Garry outfit and three other tank regiments at Camp Borden and set them up as Canada's first armored-vehicle brigade. Obsolete though



The boys of the Fort Garry Horse get their first look at a batch of old U. S. tanks





One of 200 U. S. tanks for Canada bears a message of good will

the old hell buggies were, they gave the men something to work on, a means of learning to drive and navigate cross-country, and even for group maneuvers later on. With them these empty-handed regiments could be turned into going concerns.

Bright and early the Fort Garry horsemen were on hand at the depot to get their quota of forty tanks. Experienced tank men, there to show the troopers what to do, just stood by with surprised looks on their faces. The cavalymen hitched up a few hose connections, poured a little gas in the vacuum tanks, twisted the cranks, climbed aboard, and simply drove the cats away.

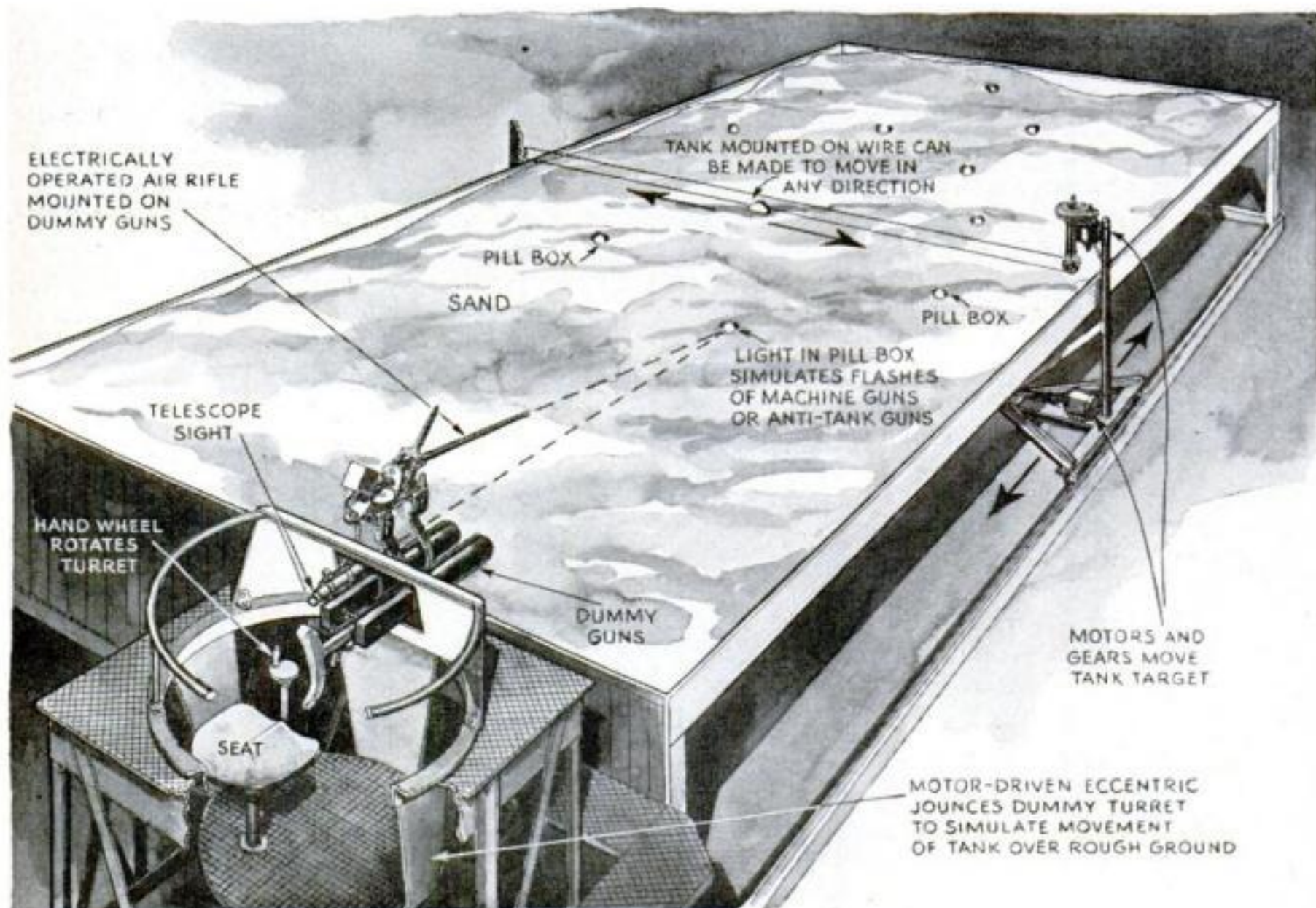
"Ride 'em, cowboys!" somebody cried—and they did.

These little six-ton, two-man tanks (American-made

## BOUNCING "RYPA" TRAINS CANADIAN TANK GUNNERS

FOR teaching gunnery at the Canadian tank school at Camp Borden, Ont., a training device called a "rypa" simulates the roll, yaw, pitch, and alternating oscillation of a tank in action. Looking through a tele-

scopic sight, the gunner turns the revolving turret and aims a dummy machine gun at moving targets on a sand-pit range. An electrically operated air rifle, aimed with the machine gun, shoots lead pellets.



Handling a machine gun in a hell buggy is like shooting ducks from a boat. This device teaches the knack



on the Renault model) were tough-looking babies, weathered for more than twenty years in a parking lot at Fort George G. Meade in Maryland, many of their hulls and turrets pitted with machine-gun marks, presumably from the last war. They clattered along on wide steel plates with heavy lugs (a far cry from the flexible chainlike links of speedy modern tracks) which slapped on the ground and limited speed to six miles an hour. But the engines and running gear were O.K.; they had been greased up well when put away. And if the old-style tracks were good for only 150 miles on these sands at Camp Borden, that was fine. So much more repair work to be done in the winter.

Back at their own quarters, the Fort Garry boys went to work. Within three days, twenty-five of those forty tanks were out in line, purring like kittens, and the rest were well on the way.

The boys clattered up and down in the open spaces among the barracks. For a man who has driven a car there are only a few things to catch onto. The controls are almost the same as a car's, except that you practically sit on the floor and instead of a wheel you have two clutch levers, one for each track. Pull back the right lever, it disengages the clutch of the right tread and turns you in that direction. Unlike most cats, a still harder pull brakes the track, and you make a hairpin turn. It is in rough country that the cat man's skill comes into play. There the novice can easily tip over a fast tank, perhaps kill his passenger if the turret above is open. But the experienced man will instinctively spin her when she tips, quickly turn her nose straight down the grade.

Anyway, the boys took to the equipment like ducklings to a mud puddle. And old horse soldiers happily realized something: the Northwest still breeds good horse riders; but the same lads are part of a whole generation which has grown up in North America since the last war, a generation which practically cut its teeth on a spark plug and was weaned on a carburetor.

That is something worth remembering in these gloomy war days. Since the disasters of last May, all of us have been centering our thoughts on aviation, on assembly lines,



The commander of Canada's first tank brigade takes a look at one of the U. S. jobs



"Worthy"—Col. F. F. Worthington

machine tools, and craftsmen who can split a thousandth of an inch. These things are all important, and military aviators have to know their trigonometry. But when armored vehicles are produced, it's going to be the back-yard and the back-country mechanics who fight with them. If Britain is to win, there will be more war on the continent. And whether they take off from the Near East or from a beach-head on the Channel, that's when you're likely to hear more of Canada's cat-skinners, and of their salty, peppery, pint-sized commander, Col. F. F. Worthington.

This is one of those sad, pathetic tales of unpreparedness, though it now may have a satisfactory ending. Worthy, as they call him all up and down Canada, was his country's bug on mechanized equipment, one of those prophets without honor which every country seems to have. The United States had Billy Mitchell, France had De Gaulle, and quite possibly in Germany today there is some ignored seer telling Hitler why he is going to lose the war.

When the first World War broke out,



Scottish-born Worthington was a young adventurer in Central America—ship's engineer, mining engineer, and machine-gunner. Fresh from fighting against Villa for Madero, he went up to Canada and enlisted in the Black Watch. In France he was four times decorated for deeds which he will now describe only as "self-preservation." He wound up the war as a captain in one of the world's pioneer armored-car outfits, known as Brutinel's Brigade.

Gen. Raymond Brutinel was a French engineer, living in Canada, who early in the last war foresaw the coming of armored, mechanized warfare. His idea was so outlandish that his outfit had to be equipped by private subscription, with guns obtained in various ways, sometimes illegal. Its original equipment was a two-cylinder Autocar truck, with a steel box built around it, mounting two Colt machine guns. When the masses of British tanks broke through the line on August 8, 1918, which Ludendorff called Germany's blackest day, Brutinel's Brigade came close behind, with machine guns on trucks, motorcycle side cars and trucks.

The battle plan for that day followed precisely the tactics used last June by the German armored divisions in France. Brutinel's column was to have dashed through and grabbed Roye, a rail center. But the battle that was visualized never quite came off, because the higher command was worried about protecting the flanks.

"But that was a tank battle, identical with what the Hun has done now," Colonel Worthington recalls today. "We showed the bugger the way. It boils me up. It's almost a shame he didn't have more tanks then, so we'd have remembered."

WORTHINGTON remembered the tanks. When Canada after the war became even more demilitarized than the United States, he stayed on with the skeleton army, waiting for the war he knew was coming. Worthy was a very popular fellow, but was always talking tanks and mechanized warfare. Kind of eccentric on the subject. Or so people thought.

Four years ago the Canadian Army established a "tank school" with Worthington in command. In the spring of 1938 he set up, in a few shacks in the deserted sands of Camp Borden, the Canadian Armoured Fighting Vehicles Training Centre, C.A.S.F. With the beginning of the war, groups of officers and men from tank regiments of the active militia were rushed in for training in tactics, radio, gunnery, and driving and maintenance, so they could go back to their own outfits and pass on the knowledge.



A World War tank shows its mettle on rough terrain

Even so, lack of equipment made it necessary to do much training with gadgets substituting for the real thing. Most ingenious of these is a device called a "rypa," a turret which jolts and pitches like the jouncing of a tank, from which the gunner shoots air-rifle pellets down a sand-pit range.

The lowlands blitzkrieg of last May suddenly brought to Canada the realization that it had done hardly anything about tank warfare. Tank building got under way almost immediately, in the Canadian Pacific Railway shops. Nothing is being said about when the new tanks will be delivered, or what they will be like. But a contract was recently let for nine carloads of pins for caterpillar tracks.

Well, I went up to Camp Borden to find out what in the world a nation at war wanted with those old World War clunks, and this story is what I found out. It is a Canadian story, but in many ways it might be a story of the United States, too. Our armored vehicles are also on order, and in army maneuvers we use ice trucks. But then again we have our own cat-skinners, and our lads from the mechanized farms, and the boys fixing their flivvers in the back yards—millions more of them than Canada. A lot of them will be getting together in barracks this winter, eager for machinery to work with. And it begins to look as though, in due course, they will be getting it.

At any rate, once the present excitement about production is over, we are going to realize strongly that there is a lot more in preparedness than machine tools. We're going to realize that the used-car lot and the despised jalopy are among the strongest links in our national defense. You can learn a lot from an old piece of machinery.



## Pigeons Are Bred with Camouflage for War Service

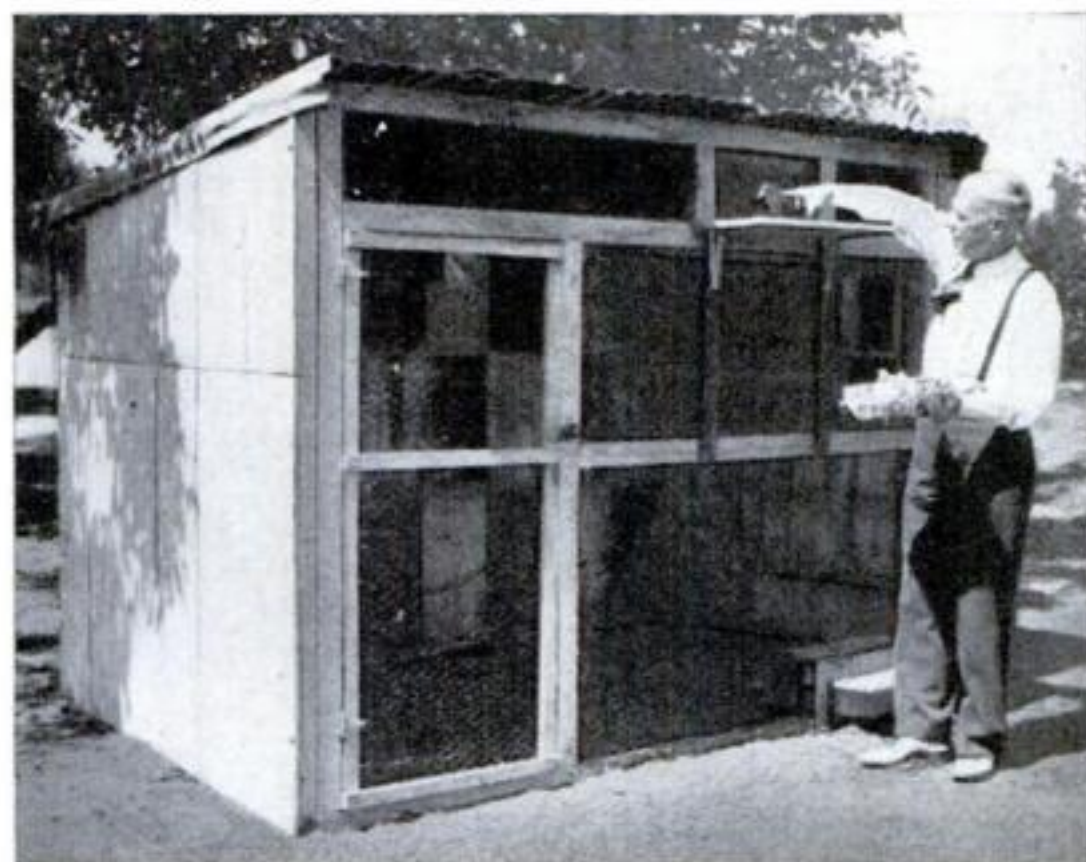
CAMOUFLAGED pigeons, with a mottled plumage to make them almost invisible to an enemy's waiting gunners, have been developed for emergency Army communication by Capt. Ray R. Delhauer, a retired United States Army pigeon expert, at Ontario, Calif. Most of his flock of several hundred birds are descendants of the hardier strains of pigeons used by the Allies and Germans in the last war.

Believing that the World War pigeons were too vulnerable because bright patches of white or colored feathers made them an easy target, Captain Delhauer bred and crossbred his birds until he achieved a strain with mottled gray and dusty white feathers on their underbodies as well as on their wings and backs.

The Army has today only 1,100 pigeons of its own for emergency communication, but Captain Delhauer believes there is just as much need for them as there was in the past. So that birds can be launched from warplanes without being thrust suddenly into a 300-mile-an-hour slipstream, he has built small metal cages with parachutes. Timing mechanisms open the cages and release the pigeons before the cages reach the ground. He has devised also a small metal message capsule, extremely light in weight, which can be inserted into a bird's crop and subsequently removed by gentle massage after the pigeon has reached its destination.



Mottled plumage of this pigeon would hide it from gunners



Capt. Ray Delhauer with a portable loft designed for field use. He breeds birds from strains that served in the first World War

Two specimens of camouflaged pigeons. By crossbreeding, it is possible to produce many plumage combinations





# PLASTICS IN THE WAR

By EDWIN TEALE



Splints of synthetic resin help surgeons care for wounded. In grafting skin and flesh, transparent coverings like that demonstrated on the lower mask allow the healing to be watched

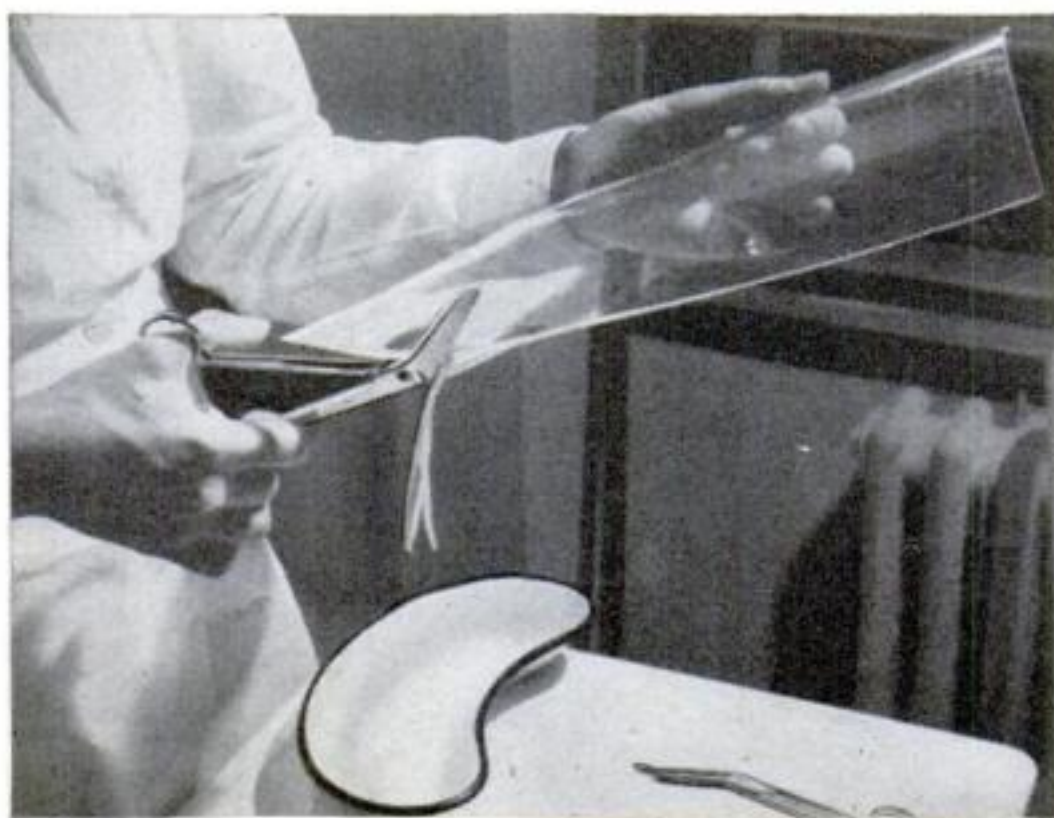
**P**LASTICS go to war!

That's the word from the armies of the world, which are making soldiers of all work of the synthetic resins that were only laboratory babies at the time of World War I.

Today this substitute is being hurried into use in a thousand ways for two important reasons. It saves the steel and the brass and the wood so vitally needed for the building of tanks and guns and ships. And it lends itself to mass production in which unskilled labor can turn out many articles of plastic in a tenth the time it would take a skilled workman to make duplicates from the old materials.

London's women donned "bombing bonnets" created from cloth treated with plastics. Munitions workers and members of the Home Guard in England wore similar helmets, made of cloth impregnated with the synthetic resin and reinforced with wire mesh. Both types are almost as effective against falling objects as the conventional "tin hats" of the front-line trenches.

That's only the beginning of the wonders that are being wrought, for plastics are being tried for everything from surgical splints and gunstocks to leakproof fuel tanks and airplane parts. And ahead lies the dream that some day



Cutting an arm splint from plastic softened by heating.



soon whole airplanes, save for the motors, will be stamped out as fast as tin cans are made now.

The peculiar properties of plastics are a major factor in their widespread adoption. A few weeks ago, for example, the United States Government ordered 2,000 army stretchers and specified that the handles should be of Tenite. This material is not affected by the poison gases of the battlefield, which corrode metal handles, or by weathering, which splits handles made of wood.

Another asset is the relative immunity of the synthetic resins to vibration. Thus they are replacing the time-honored brass cases on battleship instruments. Brass is stronger, of course, but it is much more likely to crack under the terrific vibration induced by gunfire.

In the medical field, lightweight plastic splints for use in emergency hospitals have three distinct advantages. They weigh only a fraction as much as the common wooden splints. They are transparent, permitting a surgeon to examine the condition of the bandages beneath. And they of-



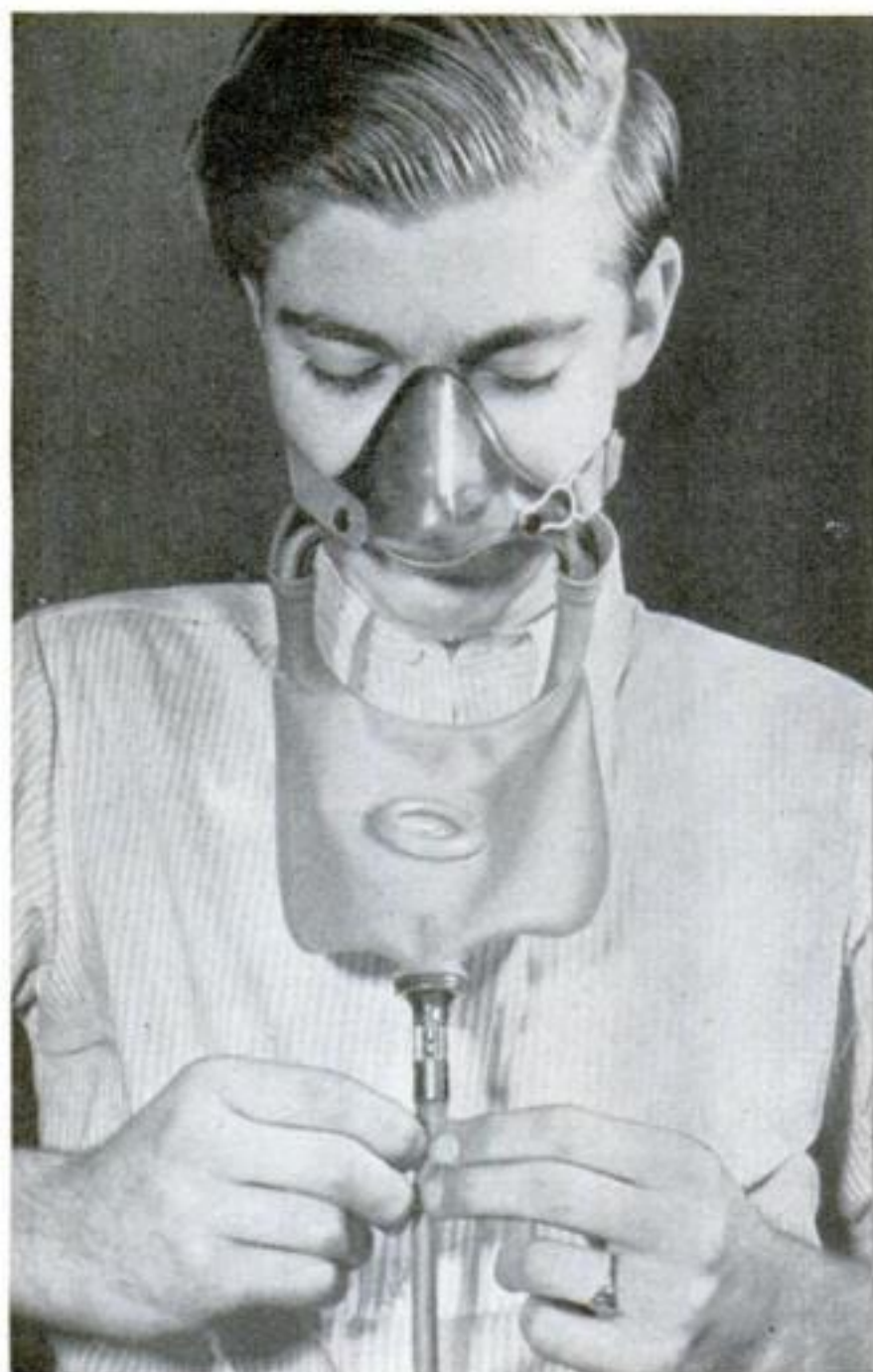
Gunners on big bombers crouch behind windows of transparent plastic

fer almost no obstacle to X-raying the broken bones at any time during the process of healing. At the Du Pont Experimental Laboratory in Arlington, N. J., such splints have been made of Lucite. They can be



Bent to fit comfortably, it is taped in place. Such a splint is lighter than one made of wood

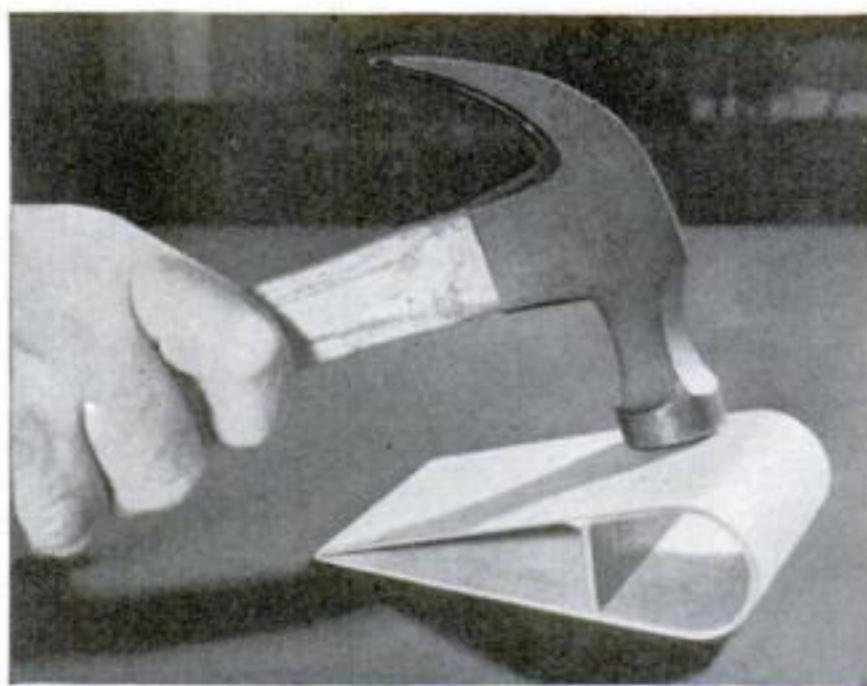




shaped by the physician to fit the various individual needs of his patients.

A variation of the idea is a synthetic-resin window for plaster casts. In setting a compound fracture, the surgeon places the transparent piece of plastic in the cast when it is made. Through this window, he can then examine the progress of the healing at any time without removal of the cast. Similarly, transparent splints permit a surgeon to be sure a broken nose is healing properly, thus reducing the danger of a patient having a crooked nose as the result of his injury.

One of the outstanding exhibits at the recent Modern Plastics Competition, in New York City, illustrated a new technique in rebuilding human faces disfigured by accidents or wartime injuries. Developed by Dr. Charles M. MacKenzie, of Spokane, Wash., the new method uses transparent splints to keep close watch on the progress of the work during the grafting of flesh and skin. Two other advances of value to the Medical Corps are a plastic spotlight for use in the operating room, and a lightweight anesthetic table equipped with synthetic-resin top and fittings. In England, a recently reported development is Bakelite coffins which can be turned out in mass pro-



Laminated-plastic construction provides light, strong control surfaces for war planes. On oxygen breathing bags used in high-altitude training, nosepieces of synthetic resins are cool and will not irritate the skin as other materials do

duction and weigh only seventy pounds.

For a number of years, American experimenters have been trying out, with varying success, gunstocks made of plastics. Recently a shotgun equipped with such a stock was placed on the market by a New England arms company. Both cheaper and easier to produce than the conventional walnut stock, it offers attractive possibilities for mass production in army rifles. According to a report from abroad, some of the guns now being used by German soldiers are equipped with plastic stocks.

In aerial warfare, the initial use of plastics came in 1918 when Bakelite distributor cases were put on the famous Liberty engines of American manufacture. From that small beginning, the use of plastics in fighting planes has spread rapidly. Today, more than 120 different parts, ranging from molded instrument panels and lightweight doors for bomb bays to de-icing devices for radio aerials, aid in protecting the lives of the crews and in increasing the efficiency of the machines. Pilots sit on plastic seats, look out through plastic windows, control their engines by means of plastic throttles, consult instruments in plastic housings. The labyrinth of electric wiring which forms the nervous system of a big bomber is insulated with the help of plastics. At night, dials on the instrument panels are lighted by glowing rings of plastic material which require only the feeble gleam of a "grain of wheat" electric lamp to light them.

When the huge bombers of the Royal Air Force head across [\*\(Continued on page 225\)\*](#)

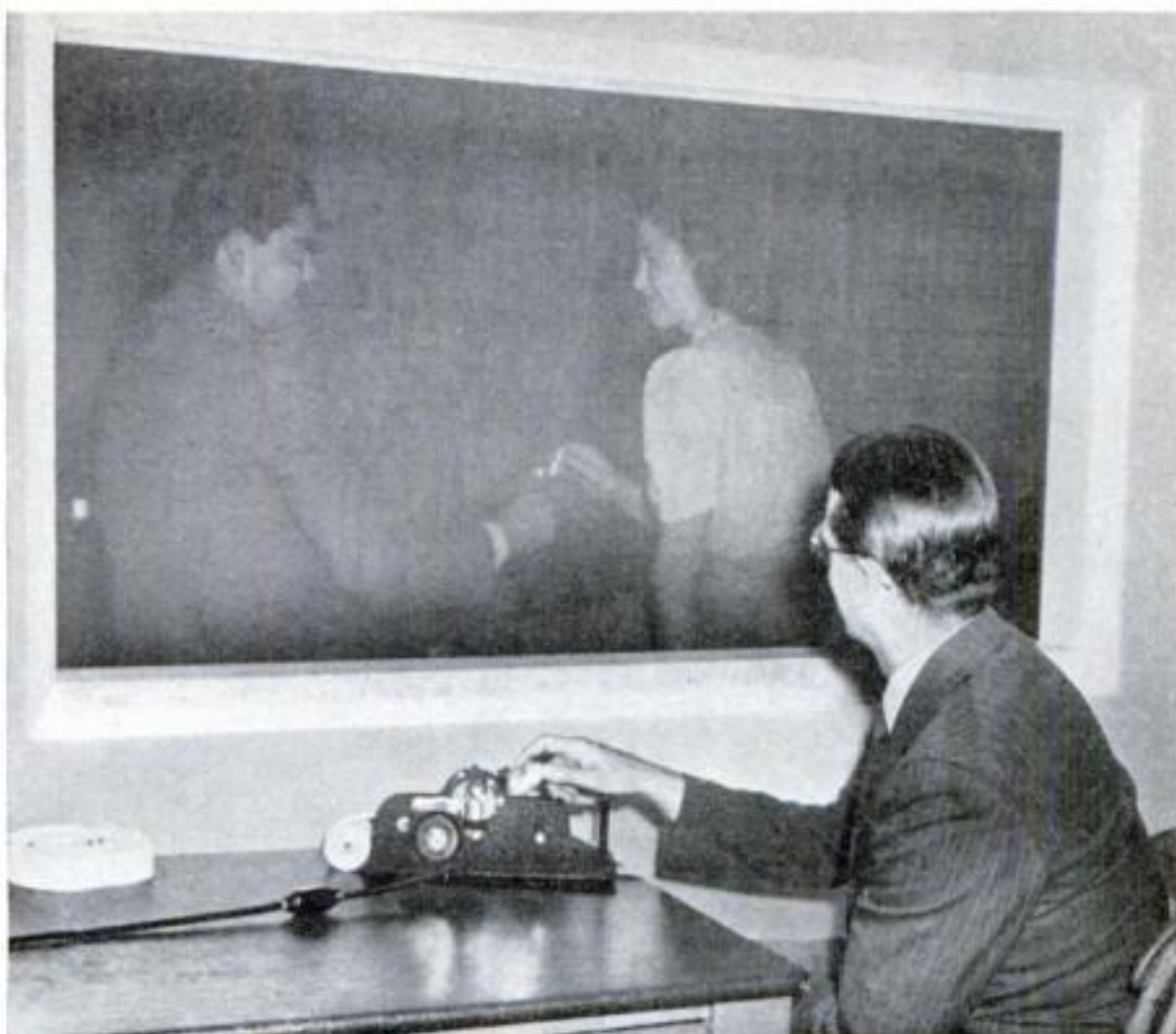


## Tests Reveal Compatibility for Marriage

CHECKING up on the compatibility of persons about to be married is a predicted use for a system for measuring human relations developed by Dr. Ernest Chapple, of the Harvard University department of anthropology. Dr. Chapple places the couple to be "personality tested" behind a screen through which he can watch them without being seen. While they chat, he records their reactions on a paper tape with a special machine. The instrument could also be used for studying personality problems of individuals.

## Machine Gives "Tailor-Made" Pressing Job

SHAPING and pressing an evening gown, jacket, or house dress is just a single operation with a complex mechanism of rods, springs, and gears invented in his spare moments by W. R. Frentzel, a Seattle, Wash., insurance salesman. Frentzel calls his machine "Symetra" because it eliminates possible wrinkles caused by pressing a garment on a flat surface like an ironing board. Measurements of the owner of a garment, sent with a dress to a tailor shop equipped with such a machine, would permit the tailor to meet exactly the requirements of the owner. The dress could be returned as form fitting, medium, or loose, as the owner wished. It would greatly simplify the correct shaping of knitted garments.



Will this couple "get along"? Watching through a screen, the scientist records their reactions on a machine which reveals their compatibility



Measurements are sent to the tailor with the dress. The dummy shown, adjusted to the measurements, then presses the dress to fit



# "SWEAT + BRAINS + TRAINING"

## Back-to-skill schools fit men for defense jobs

By **BERT ANDREWS**

**A**MERICA is on its way back to the proud position it held so long—the reputation of being the greatest mechanical nation on earth!

It's getting there fast by adopting a formula that has never failed, and by hammering it home to the youth of the nation in its schools and its shops from coast to coast.

What's the formula? If you reduce it to words, it reads this way: sweat plus brains plus training. With one more important

double-plus—a place to get that training and an incentive to undergo it.

It's that double-plus that is being provided now on an unprecedented scale, thanks to three very excellent reasons. One is a \$15,000,000 appropriation by Congress to pay for the education and reëducation of men in the skills so vitally necessary to speed national-defense production. Another is the awakening of states and cities to the fact that they can help themselves by helping their citizen... off the streets into jobs. The third is the alertness of private enterprise to the gospel of the day: "Don't weep over the shortage of craftsmen. Take raw



Skilled men are needed to assemble these plane-motor cylinders. A \$15,000,000 Government training plan



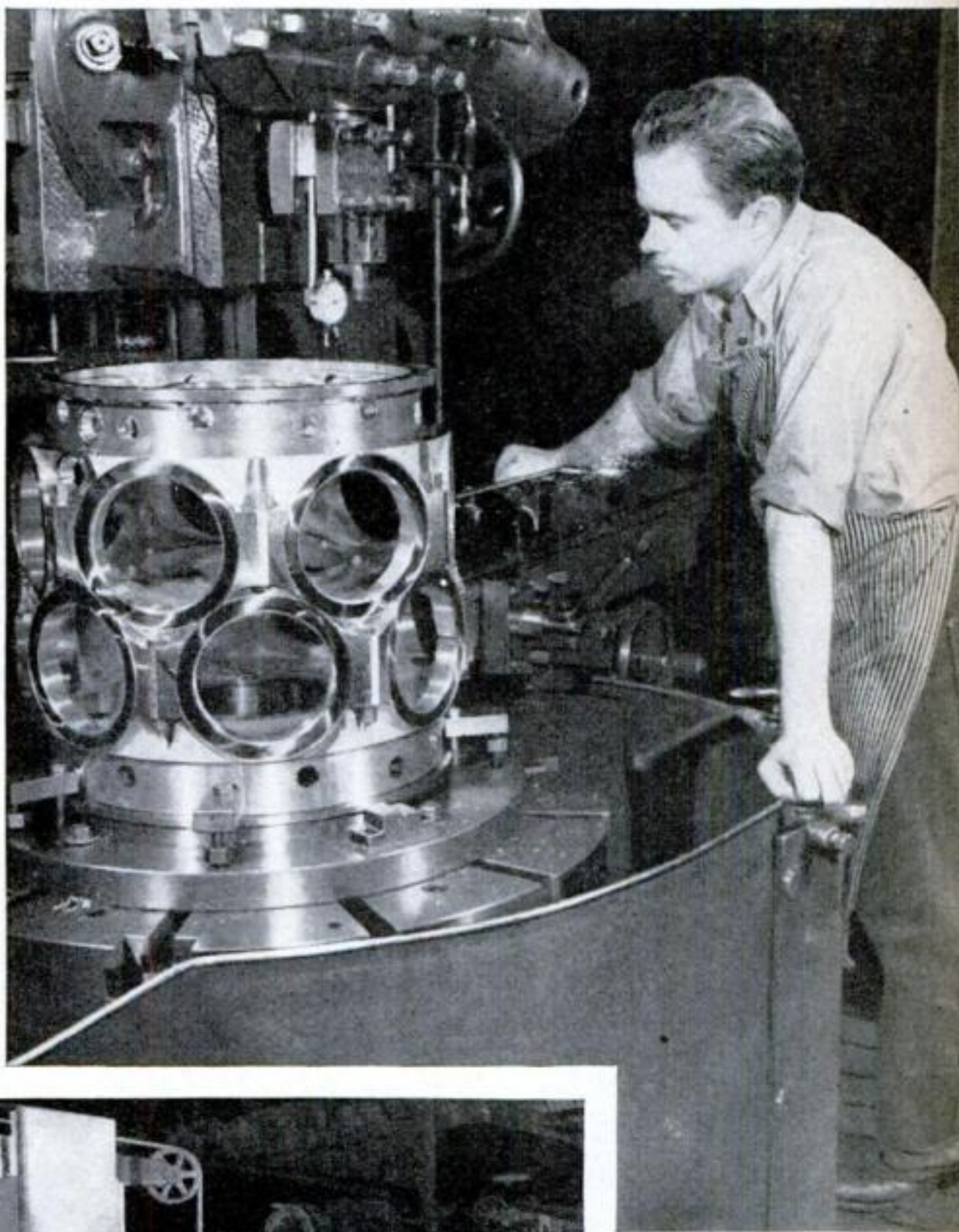
hands in and teach them, then you'll have the men you want."

Chances are that you can see some phase of this inspiring back-to-the-skills movement in your community. Certainly, the evidences of it are plain if you dwell near the great aircraft plants, from United Aircraft and Wright Aeronautical in the East, to Consolidated in the West. Or near the steel mills and the automobile plants and the electrical-supply factories that serve this nation of yours.

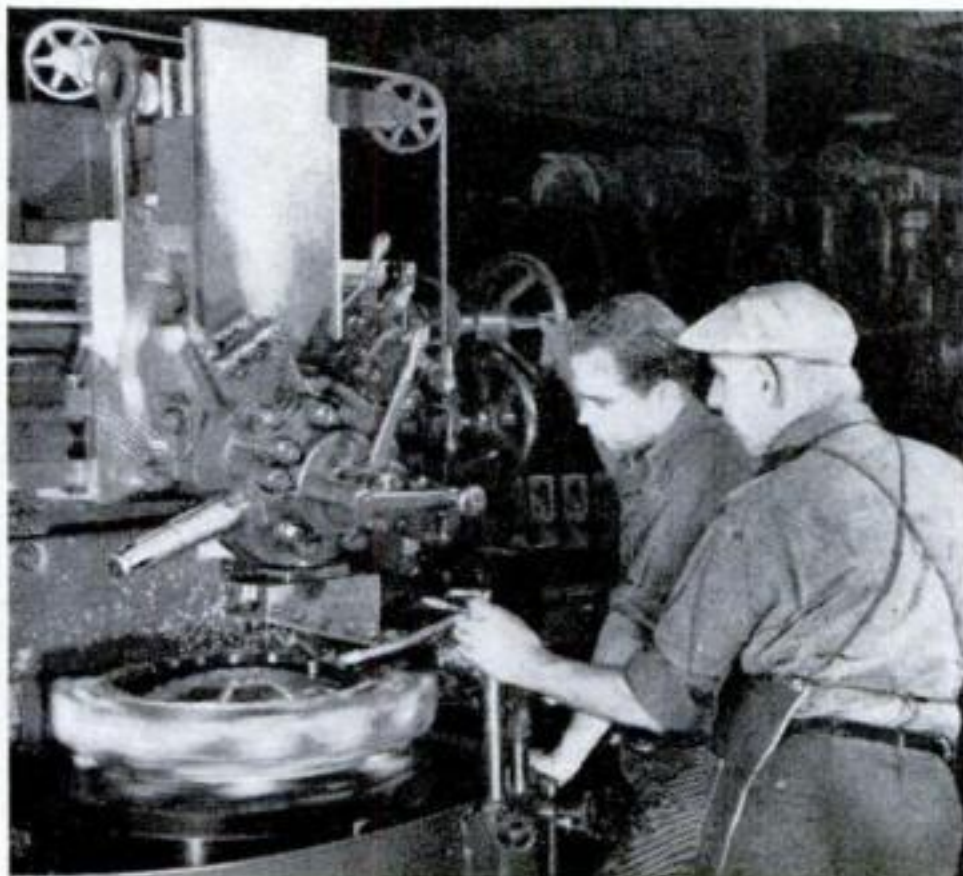
As an object lesson of what's going on about you, consider a typical state, a couple of typical private companies and two typical youngsters who have lost their silly reverence for white-collar jobs and who now understand that Grandpa was right when he said: "What if you do get your hands greasy

in a shop? You learn. And what you learn stays with you."

There's the Connecticut Plan for Job Training. It came into being because a man got mad. That man was Carl A. Gray, Dartmouth '23, a tall, lean, grayish thinker who is president of the Grenby Manufacturing Company of New Britain. One day, on a train, he heard an Oregonian complain



Morgan Jones is a product of the new "back-to-the-skills" movement. Under the watchful eyes of veteran workers, he learned how to run a Bullard vertical turret lathe for Pratt & Whitney



is helping to provide them

JANUARY, 1941



about a \$150,000 W.P.A. fly-casting pool near Portland. "Why," said the grumbler, "it won't even hold water."

The thought of the wasted money angered Gray. He knew that back home in Connecticut the machine-tool industries had been short-handed all during the depression, while thousands of young men were jobless.

And he asked himself questions. Why couldn't government and business get together to train men for jobs that were waiting? Why not make a survey of jobs and jobless? Why not try to fit the two together?

He put the questions to Governor Raymond E. Baldwin. "Go to it," said the Governor, and he forthwith made Gray the unsalaried head of a fact-finding commission. Most such commissions get out fancy reports and stop there. Not this one!

**G**RAY established eighteen vocational plants. He got the use of school buildings by convincing school boards it would reduce taxes to have young men working instead of loafing. He argued some industries into letting their shops and machinery be used at night. He persuaded other factories to lend costly tools and equipment to supplement those bought by the State. And he broadcast the word: "Come and study yourselves into jobs."

There was only one restriction. The students must live in the communities involved; obviously, the gates could not be thrown open to nonresidents, since local residents were footing the bill.

Most of the students are between twenty-five and thirty. Some are younger and some—those being retrained in lost or forgotten skills—are older. The cost? Only seventeen dollars a student. The results? Well, for one thing they eliminated in these schools men congenitally unable to handle tools. That will be reflected in future accident rates, for such men eventually would have crippled themselves or their machines.

But the benefits go much farther. Five thousand were graduated in the first twenty-five weeks. Practically 100 percent were placed. That means 5,000 removed as potential relief clients. Pratt & Whitney division of United Aircraft, at East Hartford, takes the graduates as they are or accepts them for its advanced school. Hartford Machine Screw Company grabs all it can get and asks for more. So do Colt's Patent Fire Arms Company and many others.

That's what one state has done. Study now what Pratt & Whitney is doing in coöperation with the Connecticut plan and what Wright Aeronautical is accomplishing in Paterson, N. J., and Cincinnati, Ohio.

Pratt & Whitney established in August

an advanced course for boys who had completed the basic course. They furnished building and machines and instructors, who were paid by the state. They put in lathes and drills costing from \$1,000 to \$12,000, knowing that they would be treated with a craftsman's respect.

The students select their machines on the first day. They follow through on the same machines when they graduate into jobs. They do paper work, too, including mathematics geared to high-school graduates; blueprint reading and drawing, and descriptive material related to the specific machine and what it produces. And the successful ones start getting pay checks of fifty-five cents an hour for a 52-hour week, with a bonus that sometimes doubles that. Why? Because they can do low-tolerance work—extremely delicate work in which parts must fit to a few ten-thousandths of an inch.

The Wright company in Paterson is getting places, too. The number of their workers has jumped from 4,500 to 13,500 with the defense program. They advertised for skilled men. Couldn't get enough. They went to the Board of Education. Soon a vocational school was opened with a four-weeks course and 3,500 applicants, with residence in the vicinity a "must." In six months 582 were graduated and hired, including 155 on engine lathes, seventy-four on gear cutting, 107 on grinding, 106 on screw machines.

A student who graduates on Friday goes to work on Monday morning. He begins under a skilled machine operator and in a few days is turned loose on a machine of his own. There's no limit to how high he can climb. He may become a lead man, with many machines under his direction; a foreman in charge of a department, or, if outstanding, a production engineer.

Wright's interests extend to Cincinnati, where they'll need 12,000 men to man their new plant, all to be hired from that area. They're thanking their stars that Cincinnati's big machine-tool and metal-working industries already have a four-year plan in operation to supply men who "know how."

**T**HE Republic Aviation Corporation at Farmingdale, L. I., is training 8,000 new aircraft workmen at its own expense in a near-by aircraft school. The training fees will be paid by the company, and jobs are guaranteed to those who pass their tests. The students, however, must be residents of Nassau and Suffolk Counties, on Long Island.

But let's go back to Connecticut for some of the typical products of America's revival of craftsmanship.

Meet Morgan Jones, a short, compact, light-haired man of twenty-five, who was



graduated in 1940 from Yale. He was told there weren't any white-collar jobs in aircraft for him. "Who said I wanted one?" he asked. He got a room at the Y.M.C.A. in Hartford. He completed the basic program. He went on to the advanced Pratt & Whitney course. He's now in the company's shop. And the foreman fairly beams at him as he shows his skill on a three-spindle sensitive drill, a Bullard vertical turret lathe, boring center liners on a crankcase section for a twin-row engine.

Jones is one of the five percent who are college graduates. One who isn't is Marcel Lacasse, who attended a Catholic preparatory school. He raced through the advanced school in only eighty-four and a half hours, compared with the usual 150 or 200. Now he has a job doing the work he was trained for: miscellaneous boring, facing, rough and finished turning, centering, drilling, and undercutting.

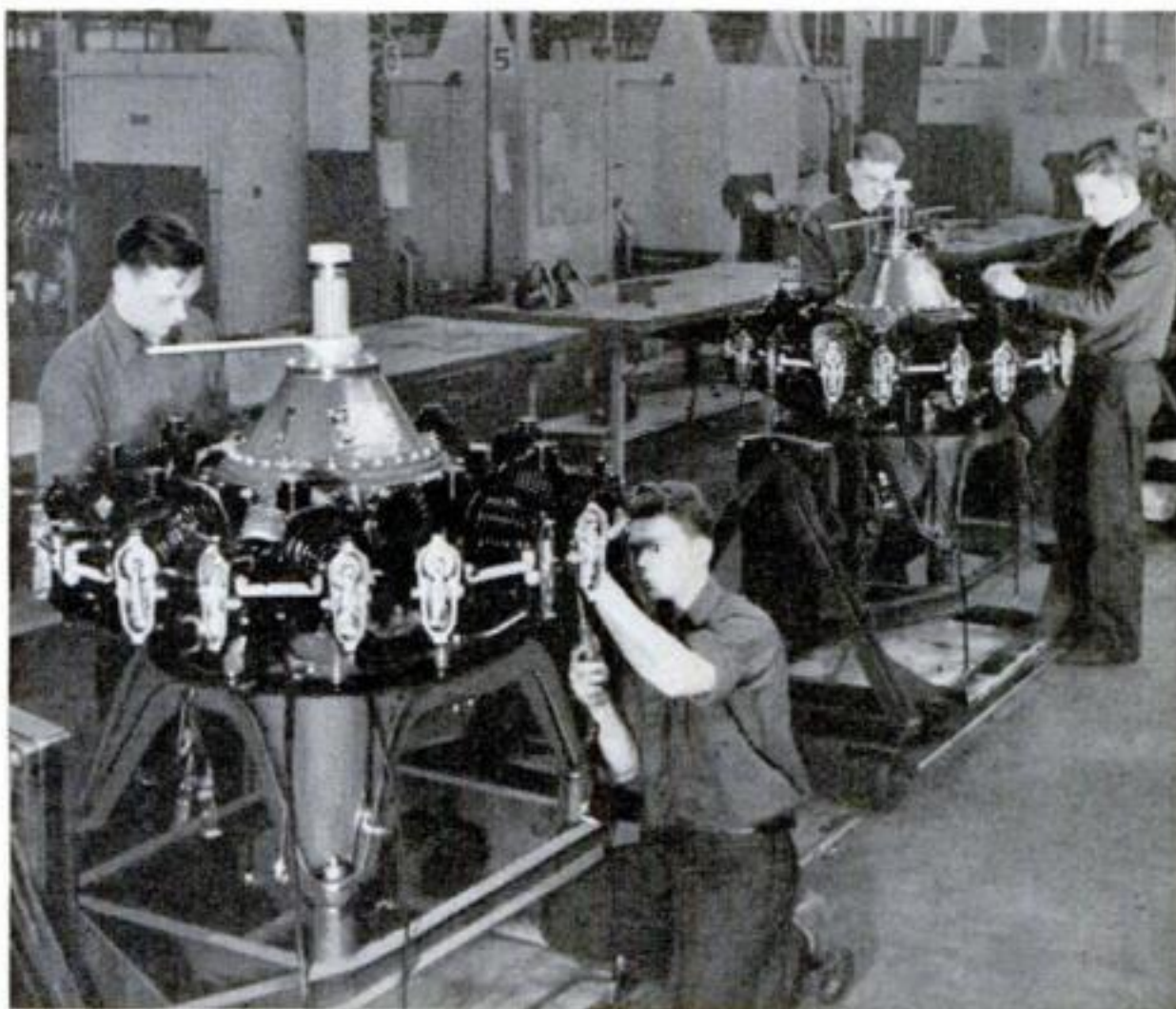
And it's such boys as these that know the answer to one question so often asked: why don't the industries simply train apprentices in their own shops? The answer is, it's not always practical, particularly under the pressure needed in turning out planes and guns and tanks.

They know the answer to another question: won't too many men be turned out as mechanics? Well, look at the figures:

The American Society of Tool Engineers estimates an immediate need for 32,570 tool engineers and 127,500 tool and die makers, to say nothing of the semiskilled men who must at least know their way around machinery. And A. F. Hinrichs, Acting Commissioner of Labor Statistics, estimates that 1,456,285 *man years* of work will be required on naval ves-



An old-timer gives a tool-and-die recruit pointers on operating a planer. Defense work has created 160,070 new jobs for tool-and-die experts



Plane motors on the assembly line at the Wright plant in Paterson, N. J. A local vocational school helped supply a 200-percent payroll increase

sels and aircraft for defense during the fiscal year that will end next June.

That's why the country needs craftsmen. That's why the training program is booming. That's why America's on its way back to the heights. And that's why a horde of men are whistling at their work in a thousand machine shops today.





## Electric Ears Hear Secrets in the Earth

**B**URIED treasure and underground pipe leaks are located easily by modern prospectors equipped with electrical detectors invented by Gerhard R. Fisher, of Palo Alto, Calif. The leak finder utilizes a sensitive crystal microphone and amplifying tubes to magnify sound 10,000 times. Carried along the surface of the ground above a buried pipe line, it picks up the faint sound of escaping liquid or gas. For finding buried metal objects, the other device emits radio waves which set up an electric field around any metal that is a good conductor. This causes a strong buzz in the earphones of the operator when the instrument is directly above the mass of metal. It has been used for locating flood-buried tractors and trucks, recovering lost coins, and finding hidden veins of galena. Another use is in prospecting for pipe lines under the ground.

A sewer official hunting leaks with an instrument that magnifies sound 10,000 times. He is wearing a suit of rubber and a gas mask

Buried in mud by flood waters, this automobile was unearthed with the aid of an electrical "divining rod" which detects masses of metal







Professional actors dramatize a famous scene of history or literature in the studio for recording

## Records Now Bring History to Life for Students

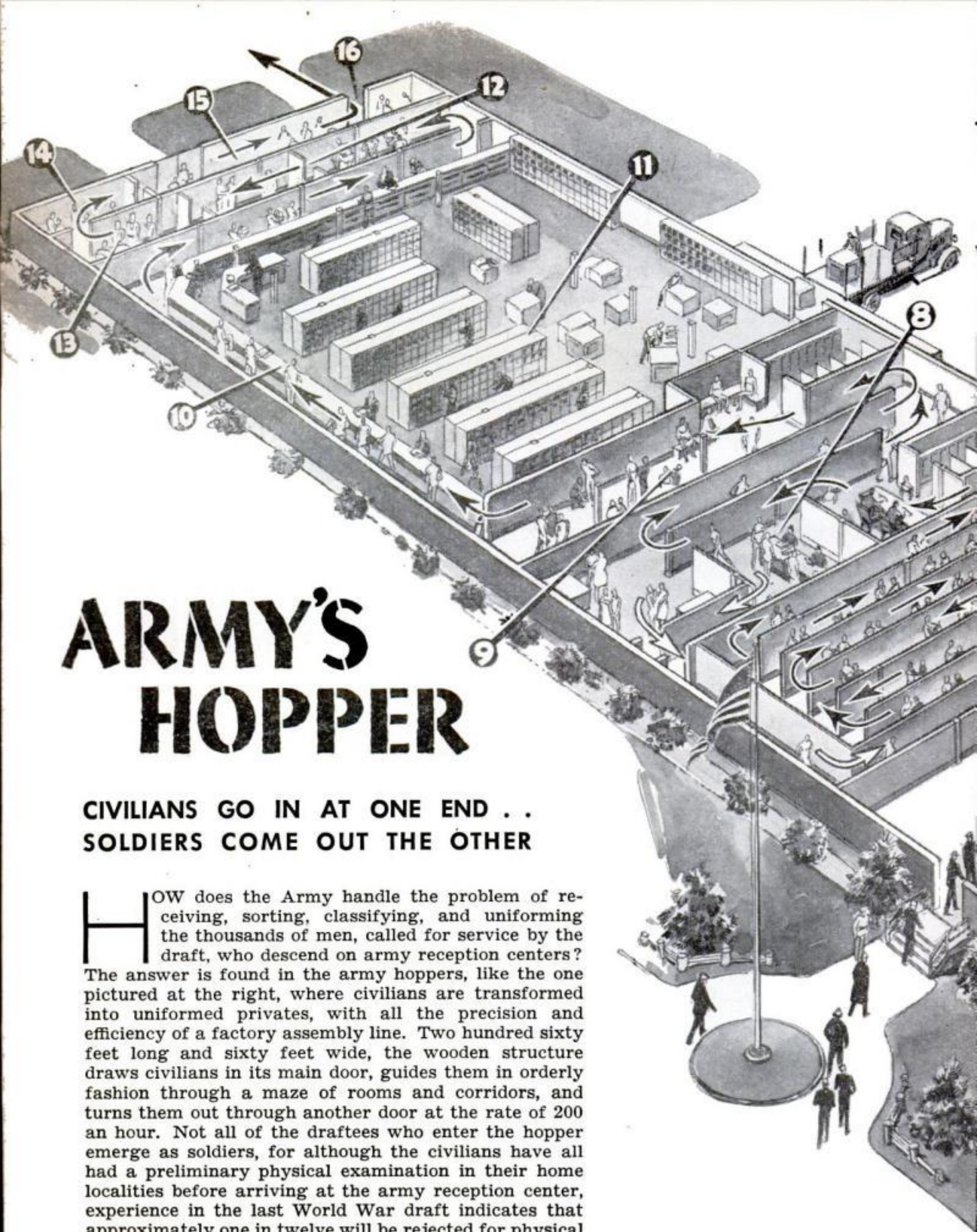
FAMOUS episodes in history and literature—stories that make people say, "Oh, how I wish I could have been there!"—have been re-created on phonograph records for American school children to hear and study. Teachers report that they make studies more exciting and real. The hoofbeats of

Paul Revere's horse, Patrick Henry's ringing defiance, Long John Silver's bellowings, Scrooge and Tiny Tim, Portia's impassioned plea—these and many more have been recorded. Mark Hawley, radio commentator, has directed the dramatizations, with the aid of professional performers and writers.



In the classroom, school children hear an episode lifted out of the dry textbooks into vivid reality





# ARMY'S HOPPER

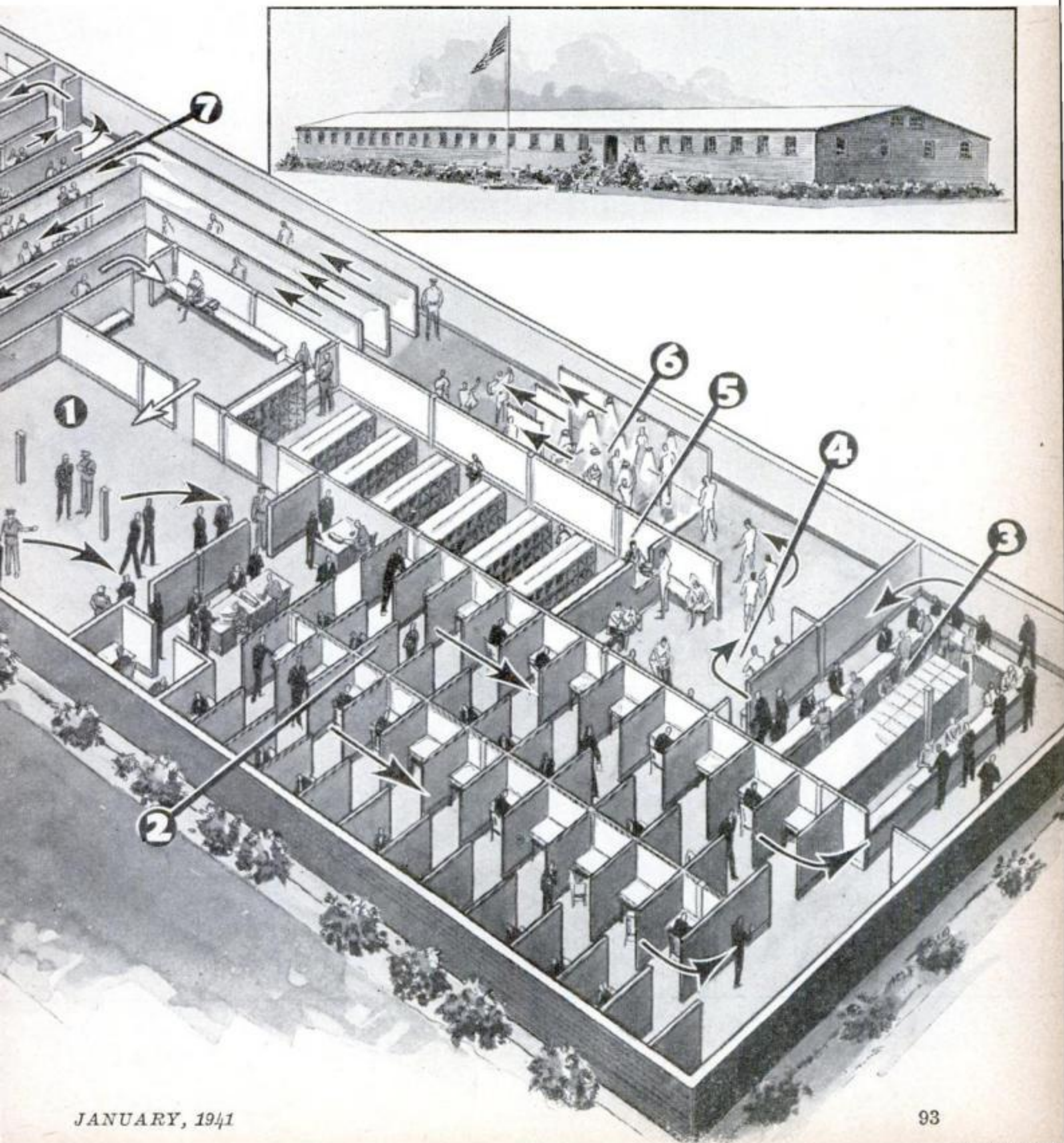
**CIVILIANS GO IN AT ONE END . .  
SOLDIERS COME OUT THE OTHER**

**H**OW does the Army handle the problem of receiving, sorting, classifying, and uniforming the thousands of men, called for service by the draft, who descend on army reception centers? The answer is found in the army hoppers, like the one pictured at the right, where civilians are transformed into uniformed privates, with all the precision and efficiency of a factory assembly line. Two hundred sixty feet long and sixty feet wide, the wooden structure draws civilians in its main door, guides them in orderly fashion through a maze of rooms and corridors, and turns them out through another door at the rate of 200 an hour. Not all of the draftees who enter the hopper emerge as soldiers, for although the civilians have all had a preliminary physical examination in their home localities before arriving at the army reception center, experience in the last World War draft indicates that approximately one in twelve will be rejected for physical reasons. Provision is therefore made for guiding the rejected men back through the same door they entered, without confusing or interrupting the steady flow of men through the complete hopper process. There is at least one hopper at the reception center for each of the nine corps areas of the Army.

Plan of the building at an army reception center where 200 draftees an hour can be transformed into soldiers. Follow one of them through the labyrinth



As civilians, the draftees enter the main door of the hopper into a reception hall (1) where they turn right into a reception office (2). Here they fill out questionnaires giving personal data and proceed to the next room where they are fingerprinted (3). This done, they take off their clothes (4) and hand them through a window into a check room (5). Now naked, the draftees walk through hot showers (6) and continue down corridors (7) where physicians give them physical examinations and turn doubtful cases over to medical boards of review (8). Rejects are shunted back to the check room (5) (follow white arrows) to don their civilian clothes and go home. The others proceed to a fitting room (9) where they are measured for uniforms, which they draw at the counter (10) of the supply room (11). The men move on to a dressing room (12), and when in uniform take a psychological aptitude test (13) before they are assigned to companies (14) and take the soldier's oath (15). They emerge at the side door (16) as uniformed soldiers in the U. S. Army.







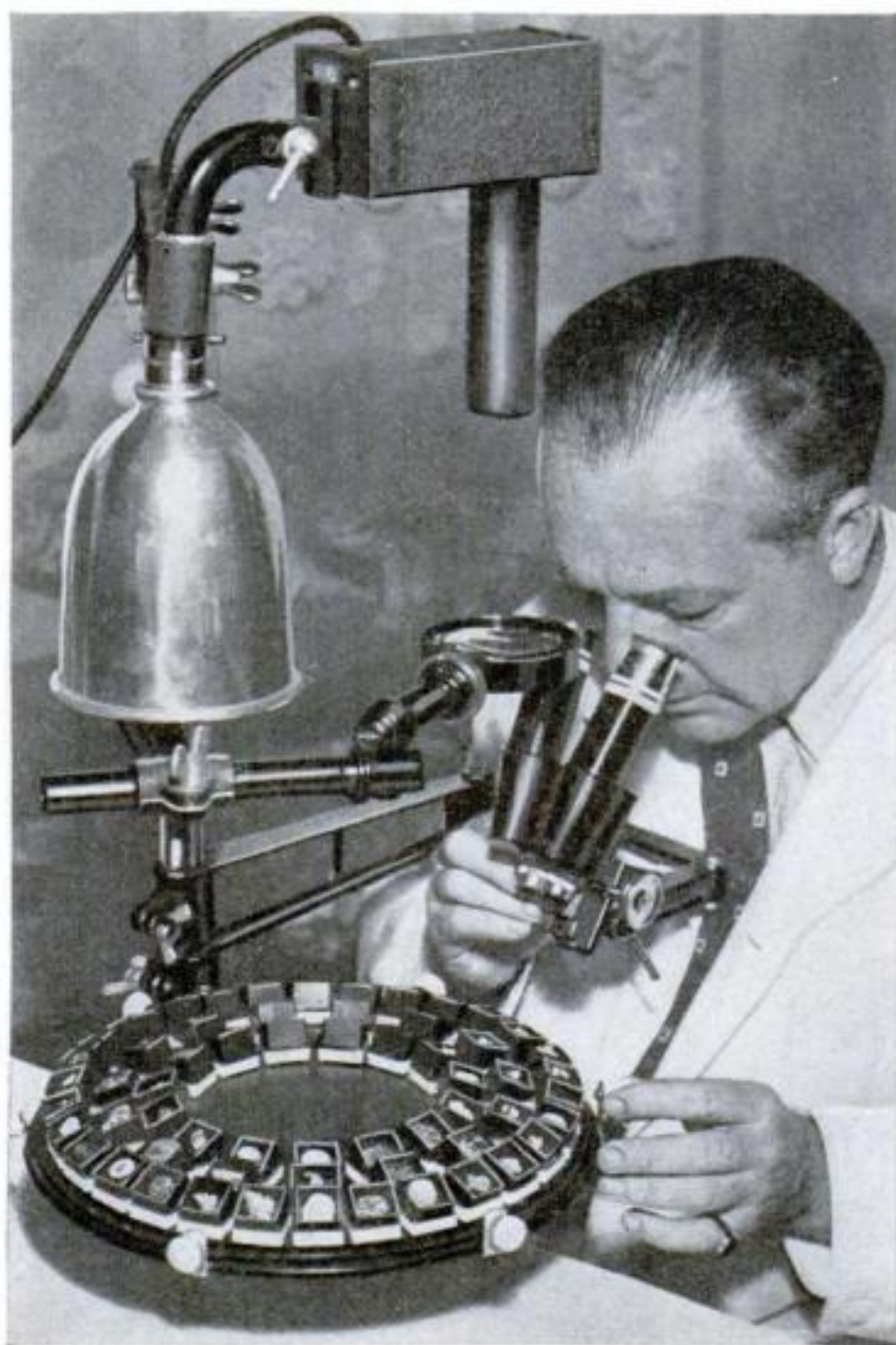
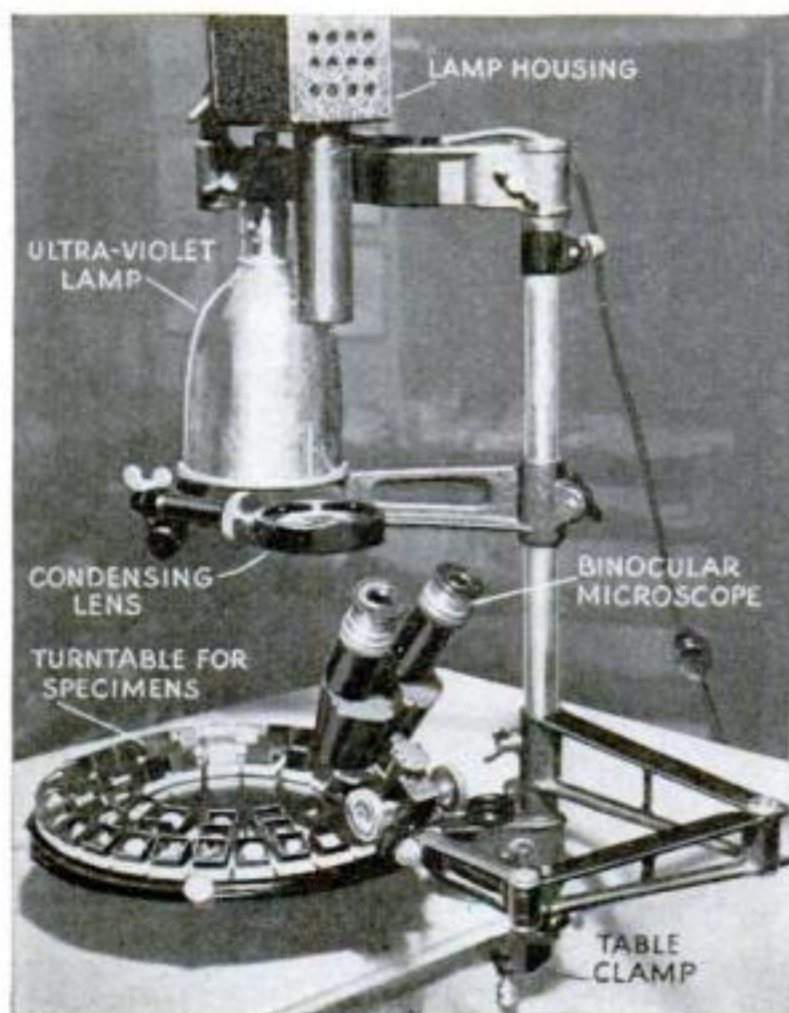
A .50 caliber machine gun can be put on any truck with this mount

## Antiaircraft Gun Mounted on Truck

MADE from a steel plate four feet square, plus materials picked up in a junk yard, a new machine-gun mount developed by soldiers of the 65th Coast Artillery antiaircraft regiment makes it possible to install a .50 caliber machine gun on any type of commercial truck. Costing only \$9.80, the mount would make it possible to outfit commandeered trucks of every type for emergency defense. Regular .50 caliber mounts can only be employed in firing from the ground.

## Microscope Stand Holds Sixty Mineral Specimens

SIXTY mineral specimens are accommodated at once on a turntable which forms part of a universal microscope stand devised for amateurs by Jay T. Fox of Seaford, N. Y. Any specimen can be brought under the lens by turning the table. For studying single specimens, the turntable is replaced by a ball-and-socket arrangement which allows the mineral to be tilted at any angle desired. The mount also supports the binocular microscope and various accessories.



Jay T. Fox studying minerals with his composite microscope stand, also shown at the left. Specimens are mounted in tiny boxes on the turntable





## Mountain Climber Engineer

Dr. William R. Hainsworth, "looking for a new way to do something," is equally at home at a desk or among mountain crags



## SCIENTIFIC FIRST ASCENTS

**D**R. WILLIAM R. HAINSWORTH, vice-president in charge of engineering and research of Servel, Inc., climbs hitherto unclimbed mountains for relaxation and devotes to his hobby the same concentration of effort which has made him one of the refrigeration industry's leading engineers. In both fields, he says, scientific preparation is the key to success.

"Whether it's a mountain or research," says Dr. Hainsworth, "you're looking for a

new way to do something. You're trying to get your feet on ground where no man ever stood before."

Untrodden heights have an irresistible allure for him. For twenty years he has been extending scientific frontiers by laboratory research and in the last twelve years he has scaled twenty-two mountains which never had been climbed before. In 1933 the American Gas Association awarded him the Charles A. Munroe medal for "the most outstanding contribution by an individual to the advancement of the gas industry," but whether Dr. Hainsworth was more elated by that recognition of the air-cooled gas refrigerator or by his successful ascent in 1938 of 12,972-foot Mount Robson, tallest peak of the Canadian Rockies, is hard to say.

Dr. Hainsworth's special delight is a mountain which has not been climbed. The spirit of the venture is the same which made him a leader in the development of the gas-operated absorption refrigerator from the water-cooling system of early days into the modern, air-cooled refrigerator.

He studies American and Canadian alpine





A peak of the Canadian Rockies snapped from a high elevation



Hans Fuhrer and Howard Carlson show trout against Mt. Robson



Dr. Hainsworth working slowly up an ice field with a full pack

journals and, selecting his field, reads all the information available and makes a study of the geologic formation. He collects all the photographs he can find of the region and studies them with the aid of maps, marking spots which look dangerous. Sometimes he has airplane photos made.

In his attack upon an unscaled peak, Dr. Hainsworth relies upon the knowledge and experience of his companions and his own judgment. Before starting his climb, he mounts adjacent ridges and peaks and checks with field glasses the maps, pictures, and notes he has brought with him. He examines his chosen mountain from various sides to be certain that he will select the most practicable route.

Generally his plan of campaign meets with success, but sometimes unexpected and unpreventable circumstances thwart him. He made his first attempt on Mount Robson in 1930, the same year in which he climbed Mount Carlton and Mount Warren overlooking Maligne Lake, near Jasper, Alberta. A succession of severe snowstorms compelled him to retire. He tried Mount Robson again in 1934 and again was driven back.

In 1932 he reached the top of Mount Oubliette, near the headwaters of the Fraser River in Alberta. Its altitude is only 10,100 feet, but its steep and dangerous slopes had baffled some of the best climbers in America. Dr. Hainsworth made his only European trip in 1936 and climbed the Matterhorn to keep in practice.

It was in his successful attempt on Mount Robson in 1938 that he had his narrowest escape from disaster. He was making his final survey of the slopes the evening before starting his climb, when a great chunk of Mount Robson's ice cap fell and started an ava-



lanche. The slide was three miles long and spread to a width of half a mile. It wiped out the spot which Dr. Hainsworth had just selected for his next camp.

"If the avalanche had come twelve hours later—good night!" was Dr. Hainsworth's comment. He worked out a new route with a new camp site and completed the climb in four days.

Of course, it takes something more than a scientific mind to make a successful mountain climber and Dr. Hainsworth has those attributes too. He was full-back on the football team of the University of Washington and still has a full-back's physique. It was in 1914, when he was eighteen years old, that he got his first taste of mountain climbing. He and another student got jobs as forest rangers during the summer vacation and were sent to take a census of deer, bear, and mountain lions in the Olympic National Forest.

"Whenever we saw a mountain that struck our fancy," says Dr. Hainsworth, "we'd take a few hours off from counting animals and climb it just for fun."

Then for some time Dr. Hainsworth was too busy for mountains. Years of postgraduate study brought him as research associate to Massachusetts Institute of Technology where he experimented in 1921 with the photo-electric transmission of photographs.

It was not until 1928, the year before he began his association with Servel, Inc., that he got around to mountain climbing again. He has several peaks on his list now and, for the last three years, he has been directing development of an all-season, gas-operated air conditioner to provide heat in cold weather and coolness in warm weather. That's another peak.



Members of the Hainsworth party exercising on snow fields . . .



. . . well below Mt. Robson, which they finally conquered in 1938



These photos are enlargements made from a 16-mm movie film





# America Raises Her Voice

By **ROBERT E. MARTIN**

A VAST expansion in its international short-wave radio stations is giving the United States a new ace to play in the never-ending game in which world powers seek to bolster their prestige over the air.

Two million dollars is being spent on new transmitters which will double and treble the power of many American stations. When the work is finished, in the spring, this nation will be able to compete, particularly in Latin America, on an even wattage with the huge short-wave stations of Europe, and thus will be able to attain three objectives: Correct false impressions about this country; provide uncensored news free of propaganda, and beguile listeners with entertainment.

No longer, then, will the smooth-voiced word dispensers of unfriendly lands be able to tell our neighbors, without getting a quick answer, that ours is a country made up exclusively of gangsters, goldfish-swallowing college boys, and materialistic business men.

There are 2,100,000 short-wave receiving sets in South America. This country's broadcasters believe that they are reaching most of them now, and will soon reach all of them, with the story of the United States as it really is.

The audience is willing; no doubt of that. For where the National Broadcasting Company received less than fifty letters a month from South America in 1936, it now gets 2,500 a month. And many of them emphasize they are disgusted with the propaganda fed them by European stations.

The great amplification of the transmitters in the United States was decided upon last summer at conferences between representatives of the State Department, the Federal Communications Commission, and officials of the twelve international broadcast stations, all privately operated.

Most of the stations will rise in power to 50,000 watts. Actually they will have much greater than 50,000-watt effectiveness in South America, for engineers have developed directional antennas that narrow the field of the broadcast to a long, fan-shaped beam pointed over any part of the world desired. And inside that beam, a 50,000-watt station has the effectiveness of 500,000 watts.

Before the construction program was ordered there were only two stations here with 50,000 watts or better. One is the 50,000-watt station WLWO, of the Crosley Corporation, Mason, Ohio. The other is WGEO of the General Electric Company, South Schenectady, N. Y., which has a power of 100,000 watts but operates at 65,000.



The other international broadcast stations and their pre-construction power were WNBI and WRCA of N. B. C., both at Bound Brook, N. J., both 35,000 watts; WCBX, Columbia Broadcasting System, Wayne, N. J., 10,000; WCAB, WCAU Broadcasting Company, Newtown Square, Pa., 10,000; KGEI, General Electric Company, San Francisco, Calif., 20,000; WGEA, General Electric, South Schenectady, N. Y., 25,000; WBOS, Westinghouse Electric and Manufacturing Company, Millis, Mass., 10,000; WPIT, Westinghouse, Saxonburg, Pa., 40,000; and WRUL and WRUW, both of the World Wide Broadcasting Corporation, Scituate, Mass., both 20,000 watts.

They will need the added power and the directional antenna to meet the competition. In 1930 there were only three short-wave stations in all Europe. Now there are at least forty, with more being built all the time. Germany constructed eight such stations in 1936 to broadcast the Olympic games, and used these as a nucleus of a system which has been augmented with the capture of each new country.

Germany has heretofore had many advantages over American stations. The German radio is financed by government funds

so that the broadcasters have been able to use as many as six transmitters for one program, feeding it out over different wave bands so that listeners finding interference on one will be almost certain to get clear reception on another. In addition, the Germans have paid many South American stations to pick up and rebroadcast programs.

**H**ITLER'S speeches are rebroadcast as many as six times by the German radio. The addresses of King George VI and Prime Minister Winston Churchill are repeated by the British almost as often by recordings.

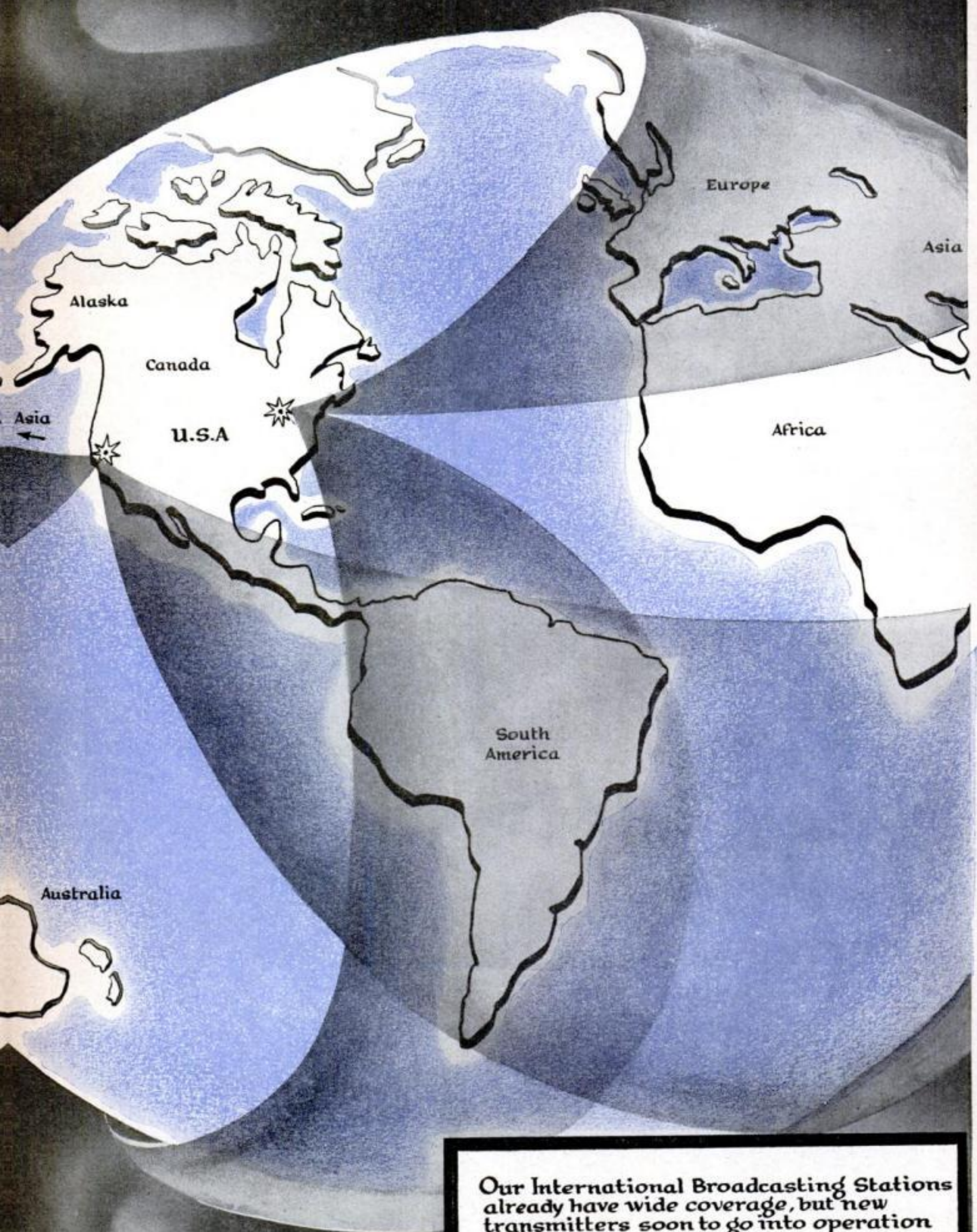
All this repetition and predominance in numbers can be offset, broadcasters here believe, by the increased power of the American stations and by the directional antenna. Dr. E. F. W. Alexanderson, General Electric's radio wizard, originally designed such an antenna to assure reliable reception by Admiral Richard E. Byrd's expedition in Little America near the South Pole. Within the past year a steerable directional antenna has been developed by N. B. C. engineers and put into operation at WRCA.

Beams of the directional antennas have proved so strong at times that the signals have passed over to the other side of the



America creates good will via the radio. One of NBC's foreign-language announcers broadcasting uncensored news free of propaganda in a program directed at South America's 2,100,000 short-wave receivers





Our International Broadcasting Stations already have wide coverage, but new transmitters soon to go into operation will double and treble their power to put them on an even wattage with Europe's biggest short-wave stations..



world. A listener in Melbourne, Australia, wrote N.B.C. that when he accidentally tuned into the South American beam "I was surprised to find my receiver almost blown out of my hand by the volume of your signals." A priest doing missionary work inside the arctic circle north of Nome, Alaska, astonished N.B.C. men by writing that he had been enjoying the descriptions in Spanish of the fights in Madison Square Garden.

For several years America's stations have been devoting themselves to the patriotic service of sending out honest information to the countries in which foreign propaganda has been at work. They have broadcast operas, symphony orchestra concerts, and oral descriptions of cultural pursuits in this country, all intended to show us in a better and fairer light.

The news reports have been most popular. N.B.C. sends out fifteen minutes of last-minute news every hour on the hour for sixteen of the twenty-four, giving it alternately in Spanish, Portuguese, French, Italian, German, and English. In all, the American stations are short-waving thirteen hours and nineteen minutes of news a day to Central and South America.

American radio stations, by feats of unparalleled speed in reporting, have scooped the official German and British government radios on their own most important news, by margins of a half hour or more. English listeners heard from the American stations their first news of the invasion of Norway.

President Roosevelt's major speeches have been put on the air in Portuguese and Spanish within thirty-five minutes of the time he has delivered them. Swift, highly skilled translators have made it possible. N.B.C. has repeated the President's remarks as often as three times in Spanish and twice in Portuguese to be sure that all parts of South America, which stretches from east to west across six time belts, can hear it.

Besides the sober work of improving American international relations, the short-wave stations have their more informal moments. WGEO has a "mail bag" for Admiral Byrd's men on Friday nights, broadcasting messages from friends. Two-way conversations on the program across the 10,000 intervening miles have come through as clearly as local phone calls.

A stunt on one of these intimate programs provided General Electric with a highly valuable property, a distinctive signal which its stations now use as their signature on the air. Short-wave broadcasters throughout the world envy the British radio, which has the chimes of Big Ben, the famous clock of the Houses of Parliament, as its identifying signal.

American broadcasters have searched for

a sound that would symbolize the United States just as well. The only thing in Washington comparable to Big Ben is the Arlington Naval Observatory time signal, but the only noise that makes is a "beep-beep." The Liberty Bell is cracked and silent, so *that* is out. The noise of American steam engines was considered but rejected. One broadcaster summed it up cynically by saying that false ideas about the United States are so general that the only sound that would be recognized as the United States would be the wail of a police siren followed by the rattle of machine guns.

THEN General Electric hit on a signal which, at least for its stations, has solved the problem. Thunder and lightning storms are unknown in ice-covered Little America, so one night as a joke the engineers of General Electric broadcast to Byrd's men the crashings and bangs of 10,000,000 volts of artificial lightning created in the G. E. laboratories. "Here's something you are missing," the announcer told the men of the expedition.

The noise was most impressive. Soon afterwards, General Electric made a recording of the thunder of three man-made lightning bolts, and since then has used it as its signature on the air. The "voice of electricity" not only is appropriate for the company's stations, but also symbolizes the might of American scientific progress.



Translations of President Roosevelt's speeches are recorded and rebroadcast for different time zones





Want to be a gold miner for a day? Just follow this sign to the Seltzer Mine, where half a dollar will rent you the use of a "glory hole," a pan, and water

## Dude Gold Mine

**H**UNDREDS of amateur miners in southern California every month experience the thrill of digging out "glory holes" and panning their own gold. Not one goes home empty-handed. John Seltzer guarantees that all will find at least a trace of the precious metal.

For twenty years Seltzer worked a mine running across the mountains overlooking Haskell Canyon, which is only a stone's throw from Placerita, where gold was first discovered in California. Last year he broke his right arm in an automobile accident. Unable to work for several months, he opened his property to the public. Want ads in Los Angeles papers announced that for fifty cents a person, he would supply a glory hole, pan, water—and gold.

The novel idea caught the public's fancy. Families would spend the week-end up Haskell Canyon while Papa and the kids dug and panned. While no one has struck it rich, several have taken out enough gold to make a ring or other ornament. Seltzer shows prospectors where to

**PANNING ORE TAKES WATER,** so Seltzer rigged up this gasoline engine and pump to furnish it to his patrons



Amateur prospectors look on while their host shows how it is done

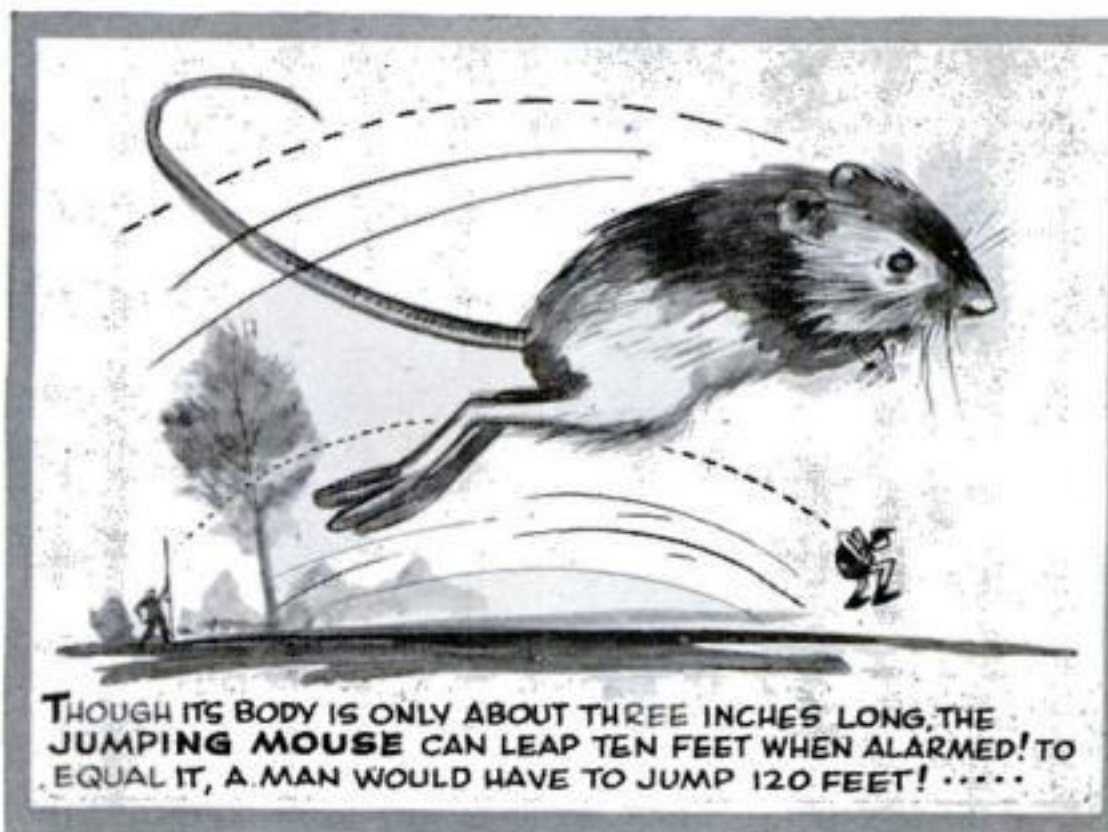
dig, and gives expert instruction in panning.

He does not promise anyone wealth. Biggest day's take from ore running seven dollars a ton is two dollars. "When anybody hits fifteen-dollar ore," he says, "I'll lock the gate and begin mining again, myself."



# Un-Natural History

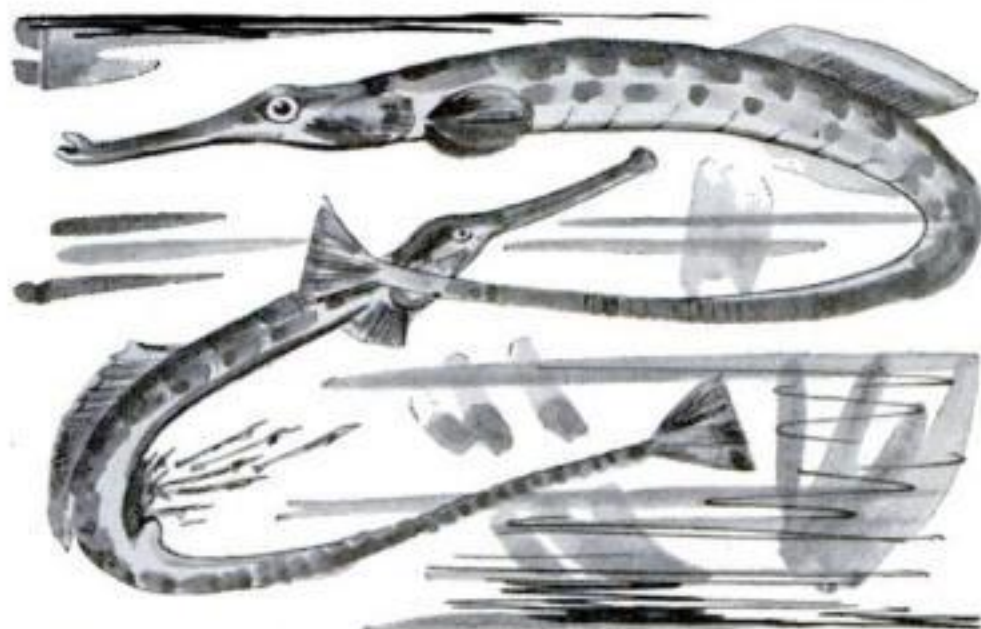
BY  
*Gus Mager*



THOUGH ITS BODY IS ONLY ABOUT THREE INCHES LONG, THE **JUMPING MOUSE** CAN LEAP TEN FEET WHEN ALARMED! TO EQUAL IT, A MAN WOULD HAVE TO JUMP 120 FEET! .....



LEAVES OF THE **APE-APE** PLANT ARE LARGE ENOUGH TO HIDE A MAN! THEY GREW ON ALL CONTINENTS IN PREHISTORIC AGES, BUT NOW ARE FOUND ONLY IN **HAWAII** ....



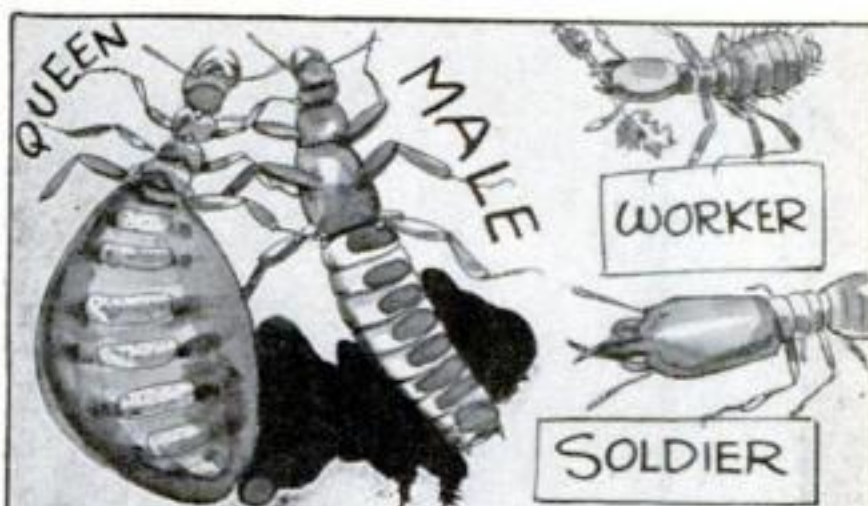
AN ASTOUNDING METHOD OF REPRODUCTION IS THAT OF THE **PIPEFISH**! THE FEMALE LAYS HER EGGS IN THE KANGAROO-LIKE POUCH OF THE MALE, WHERE THEY HATCH AND DEVELOP FROM EMBRYOS! .....



THE SOUTH AMERICAN **JACANA** SEEMS TO WALK ON THE WATER! REALLY, IT USES ITS IMMENSE, SLENDER FEET TO WALK ON FLOATING VEGETATION ....



ALWAYS ON ITS TOES IS THE LUDICROUS **SHEEP CRAB** OF THE CALIFORNIA COAST! A BORN TOE DANCER, IT DOES **BALLET STEPS** ACROSS THE KELP BEDS! .....



IN SOME SPECIES OF TERMITES, THE KING AND QUEEN STAY MATED FOR LIFE! ONE SUCH COUPLE, IN AN OBSERVATION NEST, CELEBRATED ITS SILVER WEDDING ANNIVERSARY!





Visitors to the modernized New York Zoological Park tour the grounds in comfort on tractor trains like this

By JOHN O'REILLY

**S**WEEPING changes are being put into effect at the New York Zoological Park. Through the use of new ideas, some borrowed from other parks and others the product of home-grown invention, visitors soon will be able to take an actual part in the zoo's activities.

This spring, when the new program goes into full swing, visitors will find themselves actually strolling out on an African plain populous with full-grown lions, antelopes, giraffes, and zebras. No barred cages will obstruct their view. Instead, broad moats, cunningly camouflaged, will separate the lions from the docile grass eaters and the spectators from the animals.

To create the illusion, four acres of the park's land had to be carefully laid out and landscaped. Upon entering the ornamental entrance to the group the visitor will pass through a hallway where photographs taken in Africa will be arranged in montage. As he inspects them, he hears the steady throb of the African signal drums, seeming to come from a great distance. It will really

come from recordings through an amplifier.

After being put into a thoroughly African mood, the visitor comes out upon a walk. On his left is a low wall, and beyond it stretch the plains of Africa. Zebra, eland, water buck, blesbok, hartebeest, reedbuck, bush buck and ostriches wander beneath trees which are as much like the flat-topped trees of Africa as the zoo's experts have been able to grow in this climate.

Farther out on the "plains," lions roam at will. On the right is an African water hole where animals congregate to drink. All this seems to be in one area, for by a clever arrangement of ledges the separating moat is concealed.

The exhibit will be open from May to November. Winter quarters have been built near the group and some of the hardier creatures, such as lions, will be turned into

# MECHANIZED ZOO



the plains on warm days during the winter.

Although the largest single project undertaken so far, the African Plains is only one means adopted to bring the zoo closer to the people.

Allyn R. Jennings, the general director, found that the park was using 4,000 pounds of butterfish a month, most of it going to the sea lions which occupy a big pool at the north end of the park. He sat down to figure out some method of helping to defray the cost of all this fish and at the same time provide more enjoyment for the public.

Now visitors at the sea-lion pool find an attendant with butterfish for sale at five cents each. If you want to feed the sea lions, you pay your nickel and the attendant hands you a scoop and puts a butterfish in it. Then you pick out the sea lion you want to feed.

Two of the sea lions prefer to stay on top of a big rock on the opposite side of the pool from the feeding stand. If the visitor can throw a fish fifty feet across the pool with such accuracy that one of these sea lions can catch it, he gets a free fish to throw.

The fish-throwing game proved so popular that after it had been in effect a week they had to get four more sea lions. The animals are fed no more than their regular ration, and when that has been eaten the game stops.

Since the sea-lion feeding made such a hit with the public, it was decided to extend it to other animals where possible. Vending machines containing scientifically prepared food for mammals and mixed grains for birds were set up at various points in the park. Before, there had been a \$3 fine for feeding animals.

By inserting a nickel in a machine and turning a handle, the visitor receives a



A nickel in the slot of a vending machine buys a bag of scientifically prepared food for feeding to the animals. For the same price, a visitor can have the fun of flinging a butterfish to an appreciative sea lion

Down come harsh "warning" signs. The public is made to feel at home





small cellophane bag of animal food. When visitors know that they can buy scientifically prepared animal food in the park, they are not so apt to feed chocolate candy, lipstick, rubber bands, and bottle caps.

Children like to ride animals as much as they like to feed them. To satisfy this desire, the park bought three baby elephants and designed howdahs for them and a loading platform. They found that llamas, used as beasts of burden in South America, were excellent for pulling a cart full of children, and another llama was provided with a saddle. A tanbark track with two loops was constructed, and now the zoo's strange riding academy is a popular spot.

In the bird house, humming birds are exhibited in a large cage with a plate-glass panel. In it living plants were arranged and on their twigs were attached small bottles of honey and water for the tiny birds.

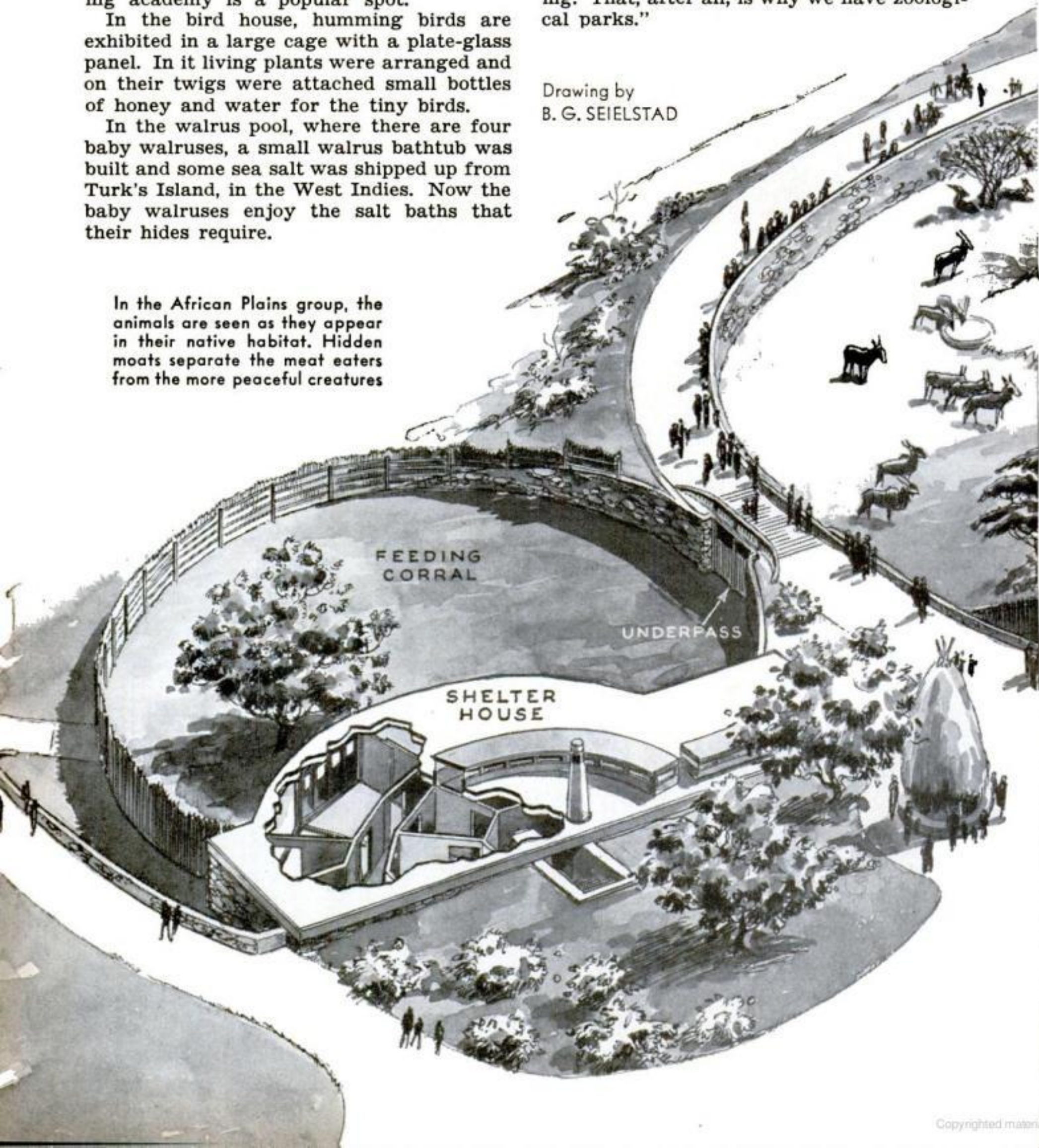
In the walrus pool, where there are four baby walruses, a small walrus bathtub was built and some sea salt was shipped up from Turk's Island, in the West Indies. Now the baby walruses enjoy the salt baths that their hides require.

In the African Plains group, the animals are seen as they appear in their native habitat. Hidden moats separate the meat eaters from the more peaceful creatures

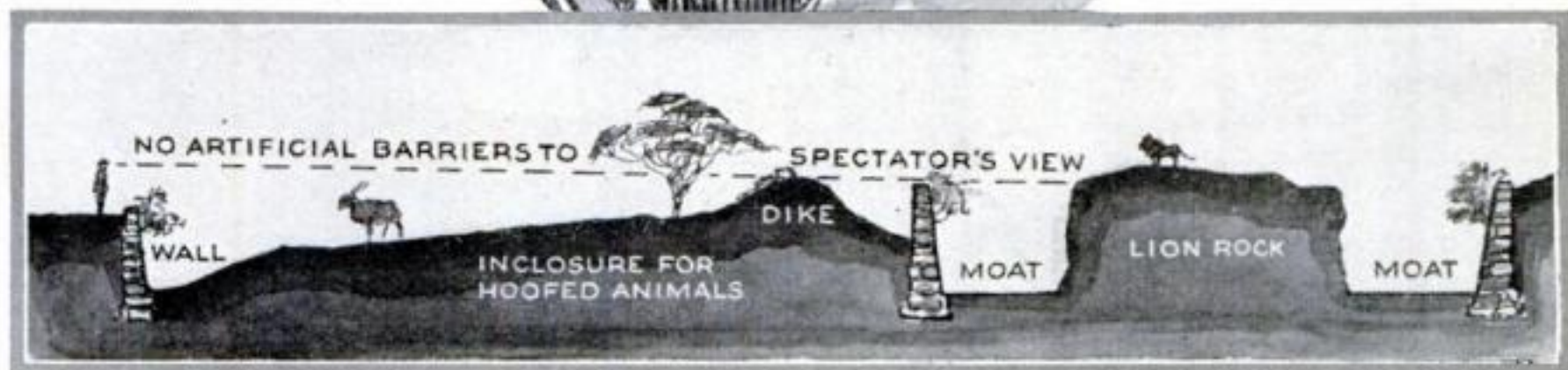
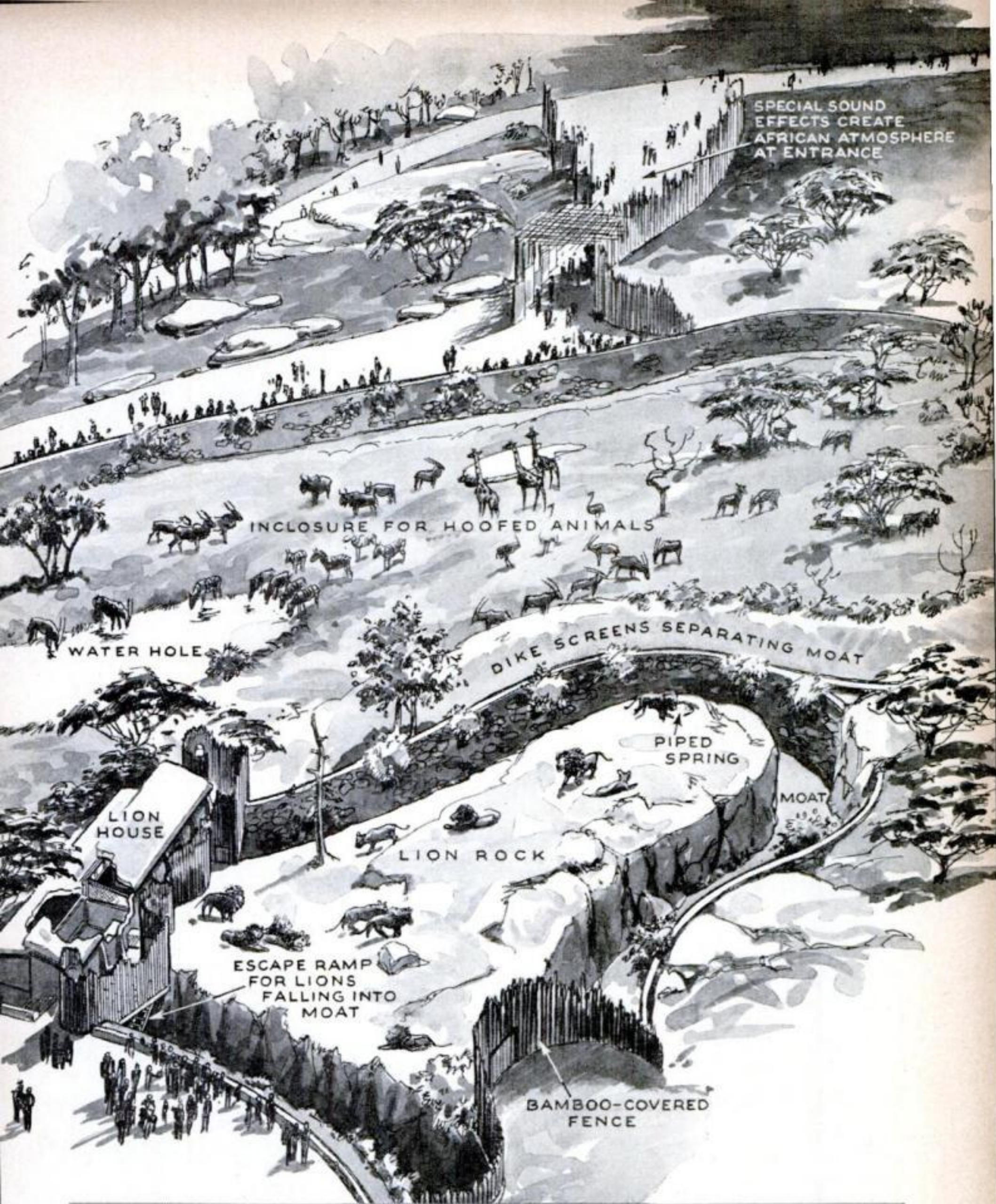
These and numerous other innovations, including a careful use of colors in painting the cages of animals that have to be confined, have been favorably received by the park's swarms of visitors. Fairfield Osborn, president of the New York Zoological Society, feels that these new steps are only the beginning of a broad program.

"By using scientific principles," he said, "we are making the park a healthier place for our animals and we are giving the visitor a chance to feel that he is participating in what we are doing. As the public become more eager, they absorb more of the knowledge of animal life which we are interpreting. That, after all, is why we have zoological parks."

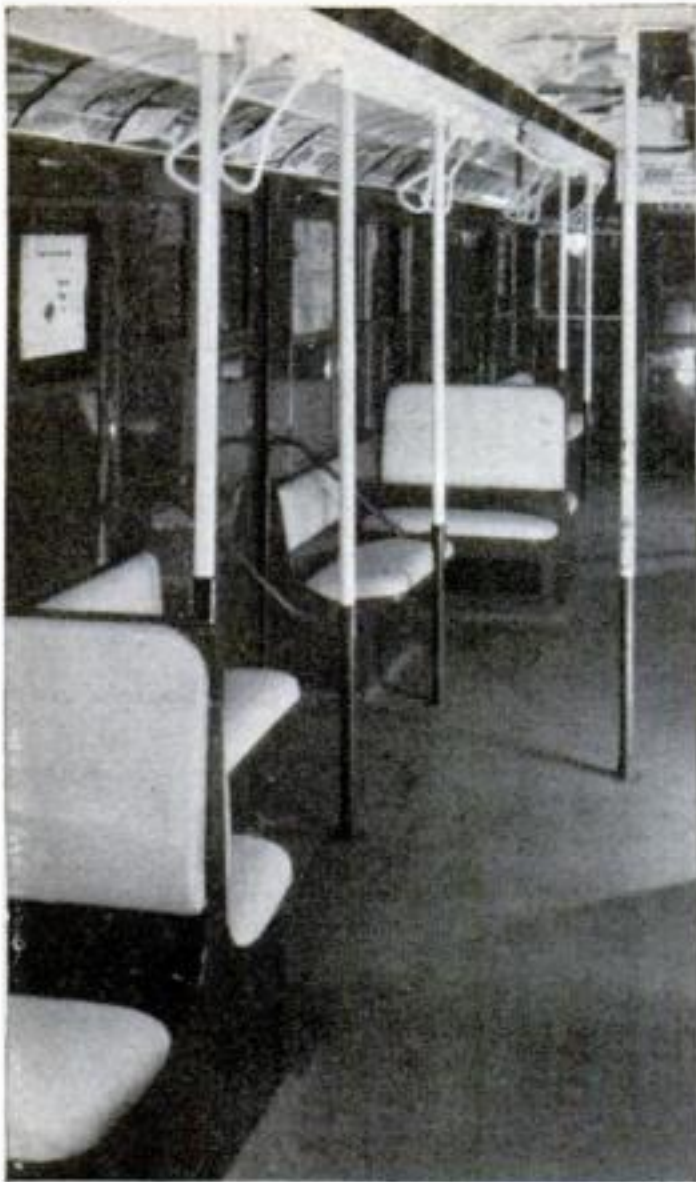
Drawing by  
B. G. SEIELSTAD



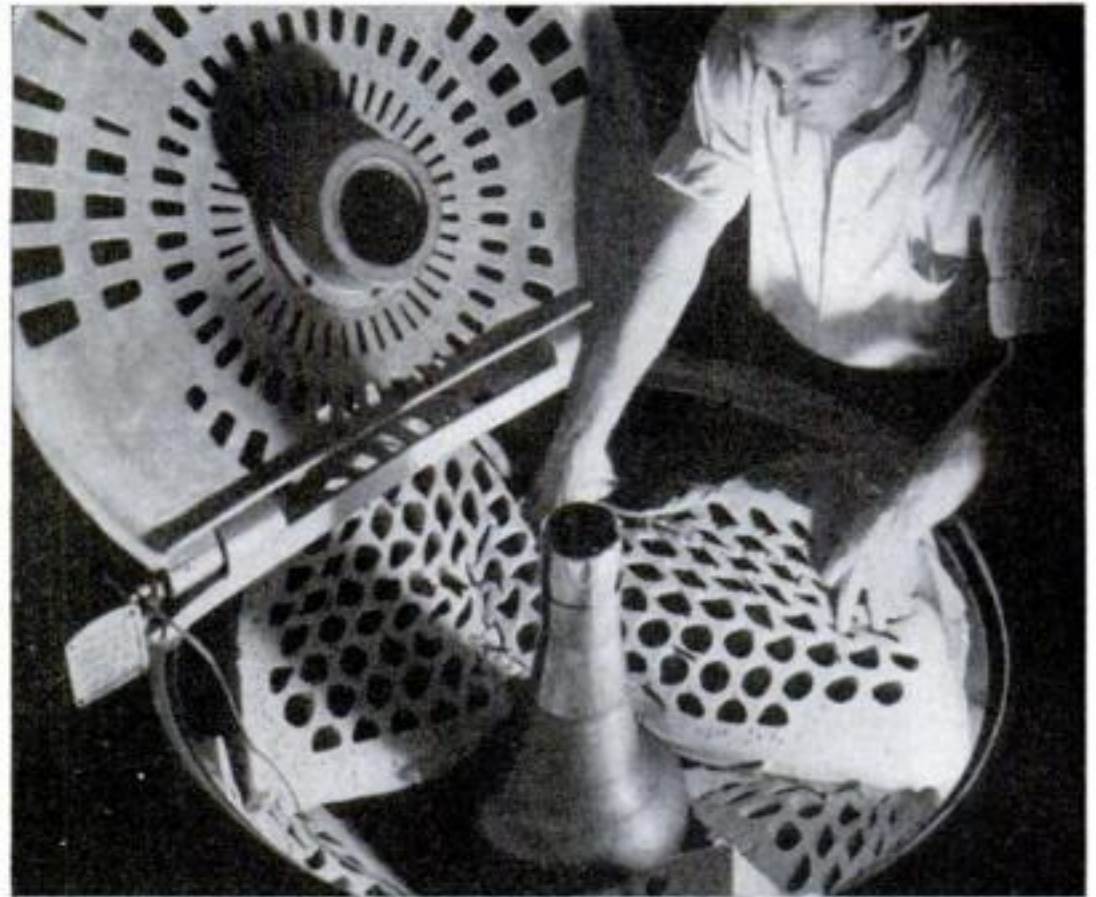








## Seats of Woven Plastic Tried Out on Subway



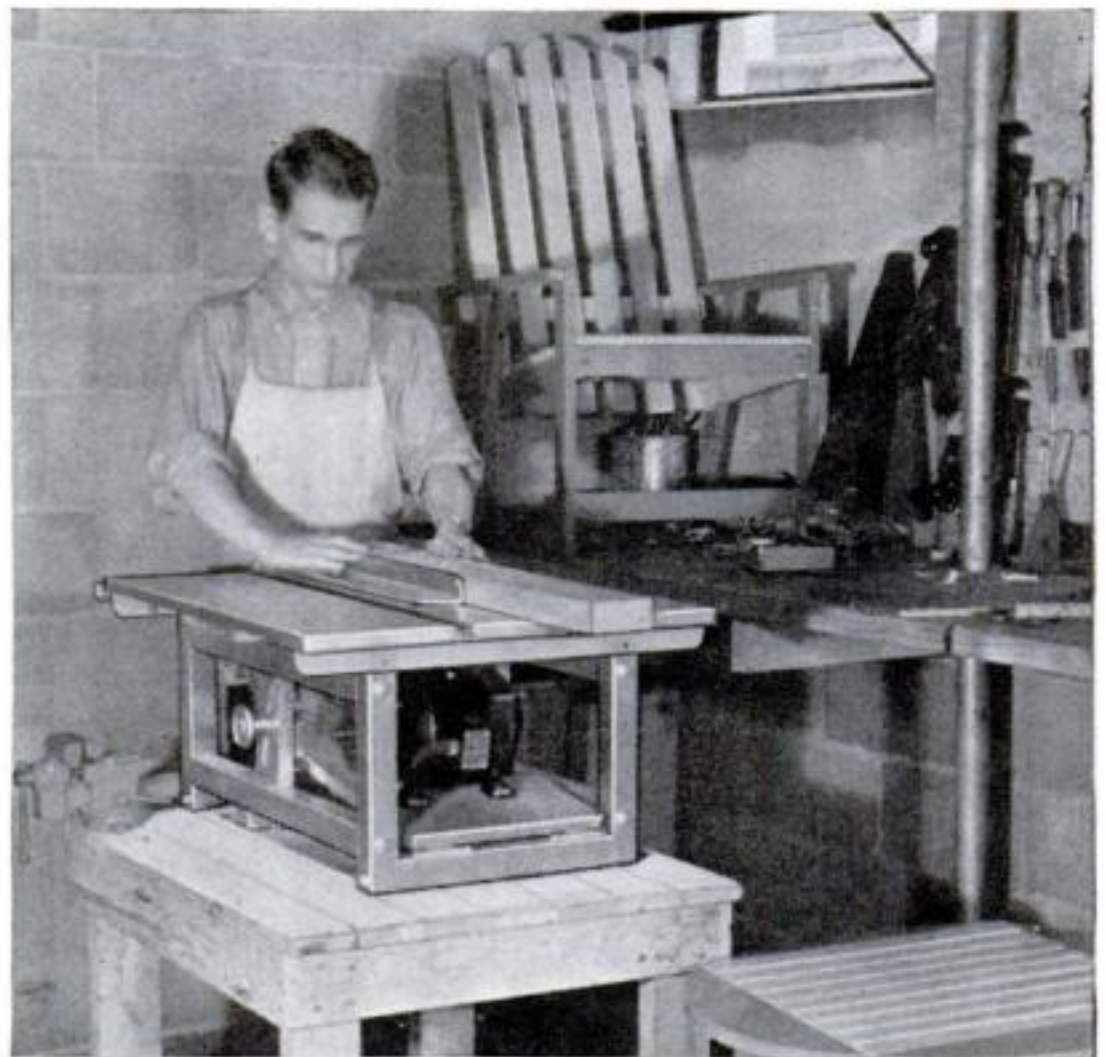
Subway car equipped with plastic seats. At right, cellular rubber cushions in a centrifugal drier

**L**ESS damage to women's hosiery, longer wear, and ease of cleaning are advantages claimed for a plastic seat covering recently installed experimentally in cars of the New York City subway system. Marketed as Saran, the plastic is produced as a continuous strand and then woven into

material resembling natural rattan seat coverings. Saran doesn't split or crack, and thus there are no projecting pieces to snag clothing. Since it is nonporous and dirt cannot penetrate the surface, it can be cleaned with soap and water. It is used with cellular latex cushions.

## Home Power Saw Is Built from Kit

A POWER SAW suited for the home workshop, which can be built from a kit or purchased assembled, is now available. Two kits may be purchased, one containing only the metal parts, the other all parts ready to assemble. Plans alone also can be purchased. Designed to rip, cut off, miter, groove, dado, and perform other operations, the saw has a twenty-four by thirty-inch top and can be powered with a motor of from a fourth to one horsepower. Kits for the complete saw include a combination rip and cut-off saw, a ball-bearing arbor, miter gauge, ripping fence, and saw guard. The finished saw can easily be carried by one man.



Ripping a two-by-four with a power saw built of kit materials





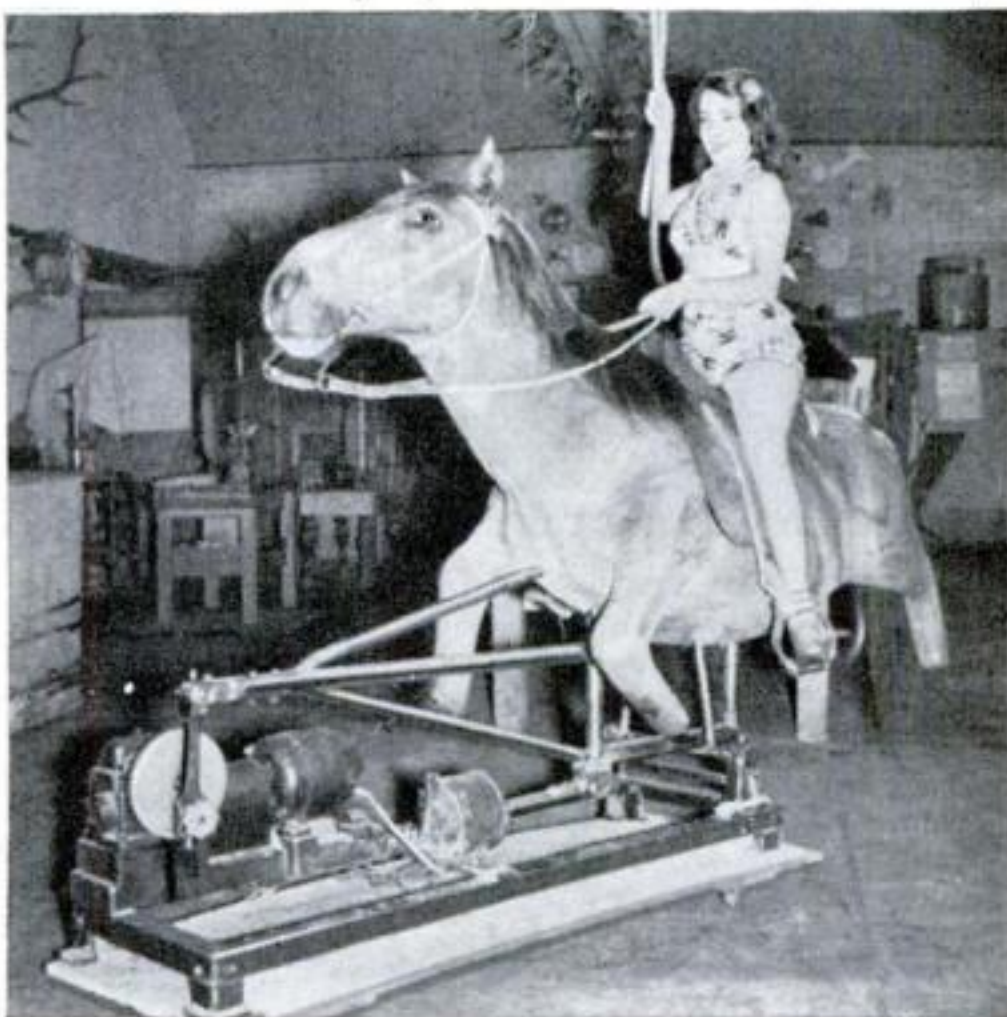
John M. Schleisser fitting the skin on a movie gorilla. Hides of three black bears were used to cover the lifelike six-foot papier-mâché body



Slabs of clay on a wire screen build up the neck of a mechanical pony that gallops realistically for close-ups

## Movie Beasts Made to Order

**W**HEN you see the face of a big gorilla flash on the screen at your favorite movie house, the chances are it's the work of John Michael Schleisser, noted Hollywood taxidermist. Working from measurements of living specimens, and sometimes from skeleton remains, Schleisser first models an animal in clay and from this turns out a papier-mâché figure which is then covered with a hide of the particular animal—or, if that is not available, with a hide of some similar beast. The hides of three black bears, for example, covered a gigantic gorilla he made recently. This animal figure, which weighs 200 pounds and stands nearly six feet tall, has head and hands of sponge rubber, which are moved by invisible wires



to give the beast animation. A pinto pony, complete from head to tail except for the feet, rides on a galloping mechanism. It is used for close-up shots in front of a screen on which moving scenery is projected.



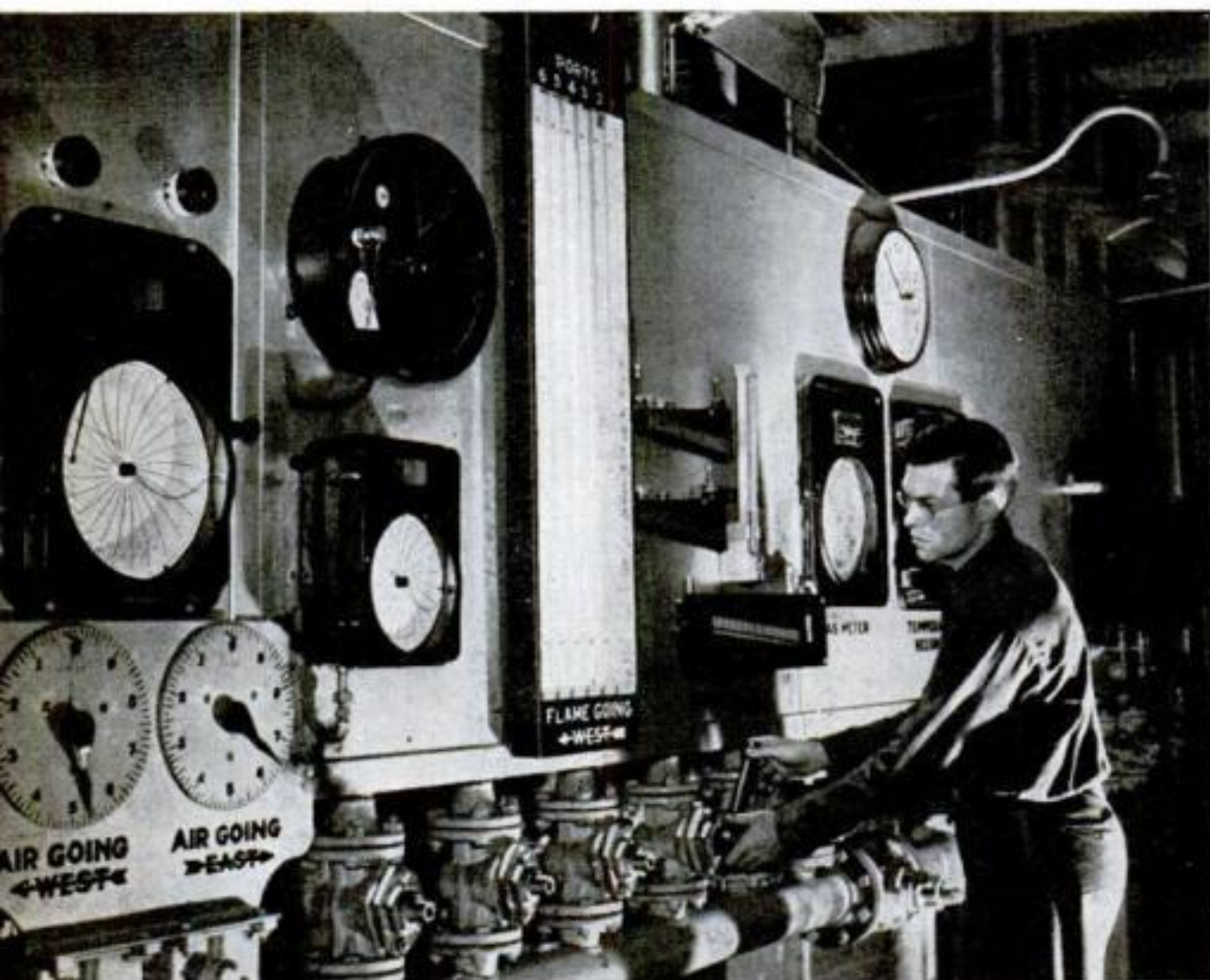
# Birth of a Bauble



**I**N ITS first year of operation, the world's only mass-production factory for manufacturing glass Christmas-tree ornaments, the Wellsboro, Pa., plant of the Corning Glass Works, has turned out more than half of all the new decorations which will bedeck

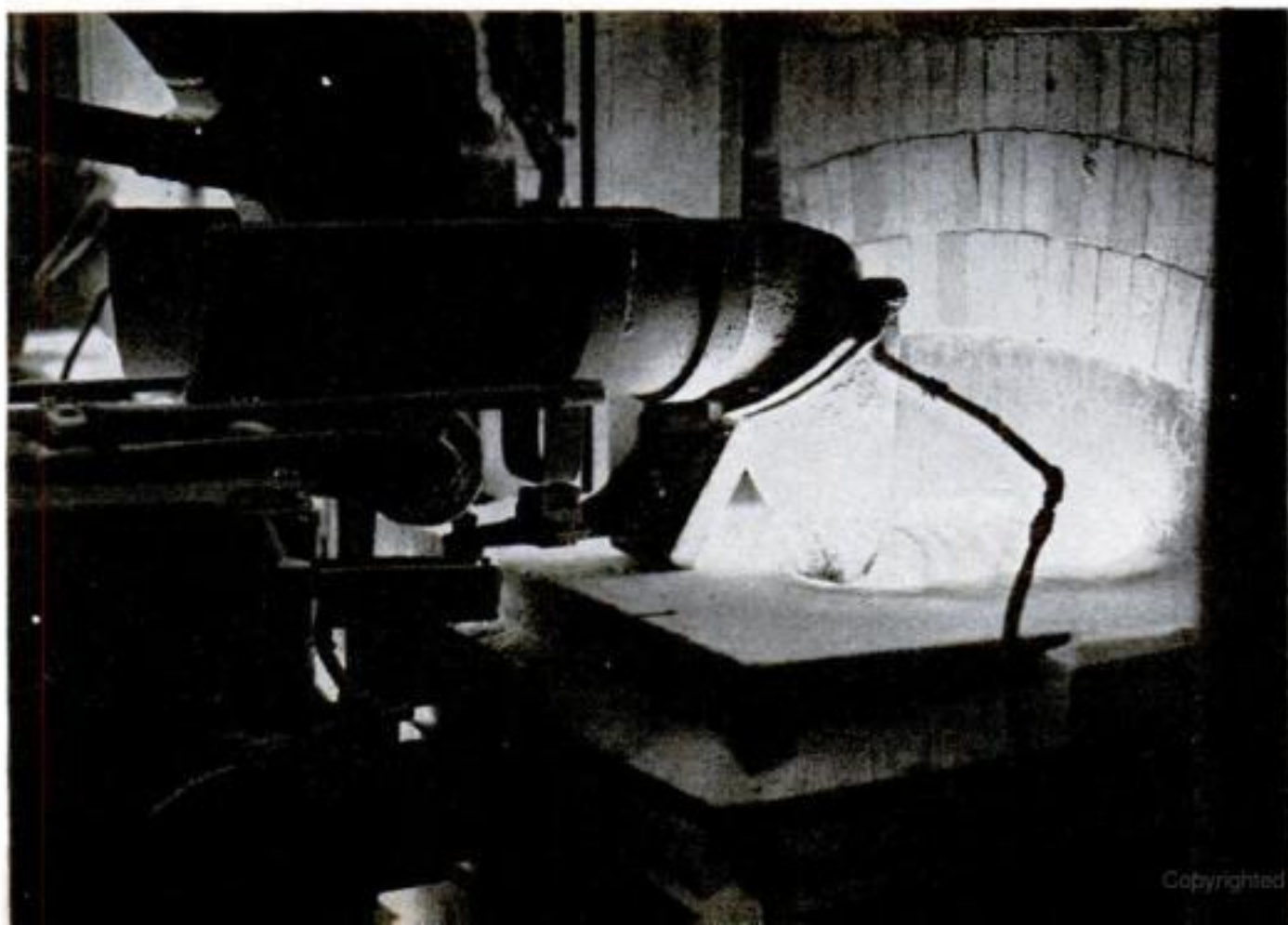
American trees this season. At the rate of 400 a minute—approximately 2,000,000 a week—the brightly colored globes have been pouring from the production line. Six months of intensive work by Corning engineers made possible the ingenious machines

which turn a pound of glass into thirty average-size ornaments. A ribbon of molten glass enters one end of the production line and a steady stream of bulbs which have been shaped, silvered inside, and tinted outside, comes out at the other end. One hundred and eighty different sizes, styles, and colors are produced at the Wellsboro plant. Formerly, most of our glass Christmas-tree decorations came from central Europe, where families of craftsmen formed and tinted them by hand. Machine methods not only speed up production but are said to turn out more uniform globes.



**1** This control room feeds air and gas to the tank furnace of the Wellsboro, Pa., plant of the Corning Glass Works, where a mixture of sand, soda ash, and lime is turned into dainty bubbles of glass to adorn America's Christmas trees

**2** Down a hopper into the furnace come the carefully mixed ingredients. It takes about three weeks to change a batch of the raw material into usable glass, which is of almost the same kind as that used for electric-light bulbs



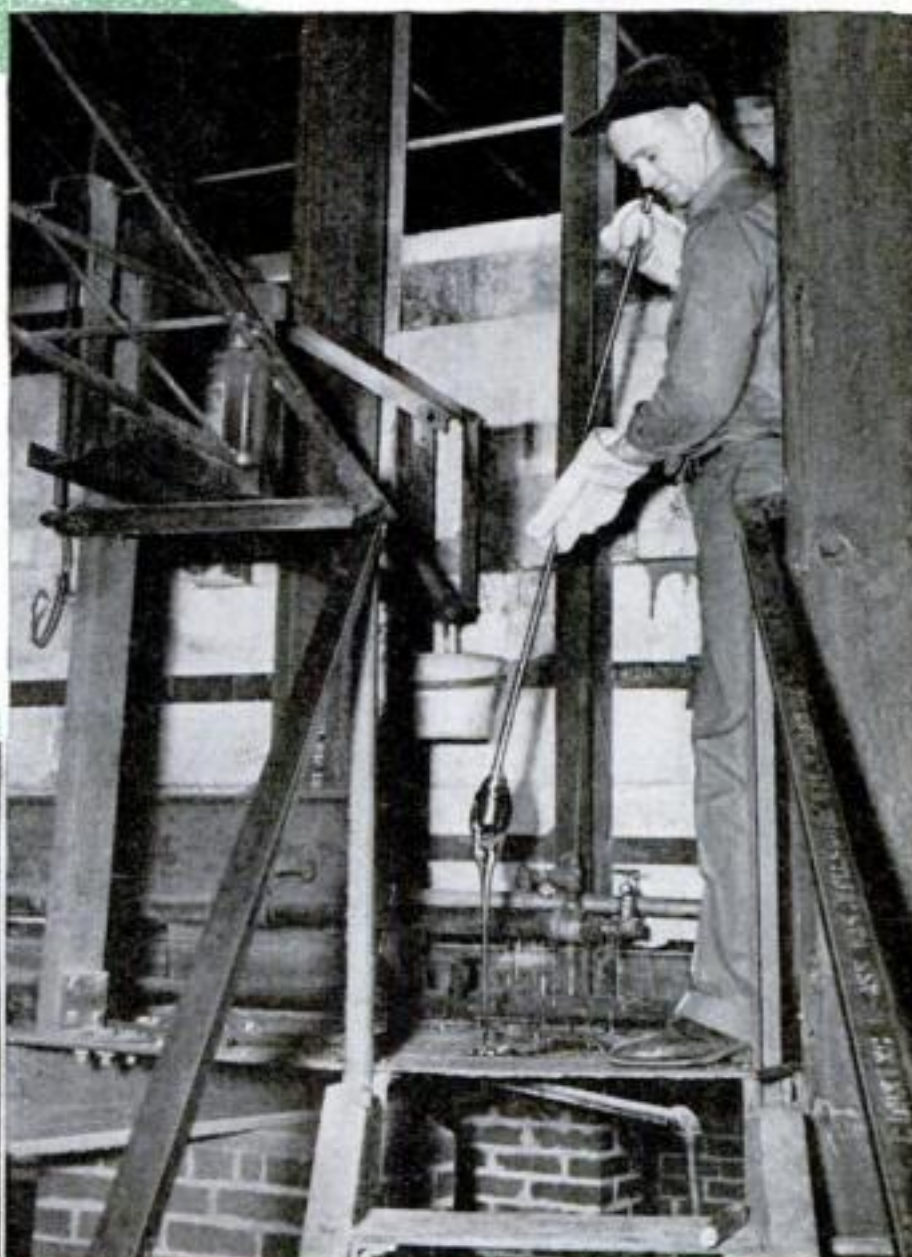




A mass-production bauble. The Corning plant makes 400 in a minute

**3** From time to time, a sample of glass is taken out of the furnace for testing. Just as an expert candy maker can tell when candy is ready to take from the stove, so a skilled glass worker can judge the quality of his glass by eye. The viscosity shows when the glass is ready for use

**4** New material is added little by little until about thirty-five tons of glass has been prepared. Guarded by steel shields from the 2,800-degree heat, a workman pushes the finely ground mixture onto the molten mass (CONTINUED)

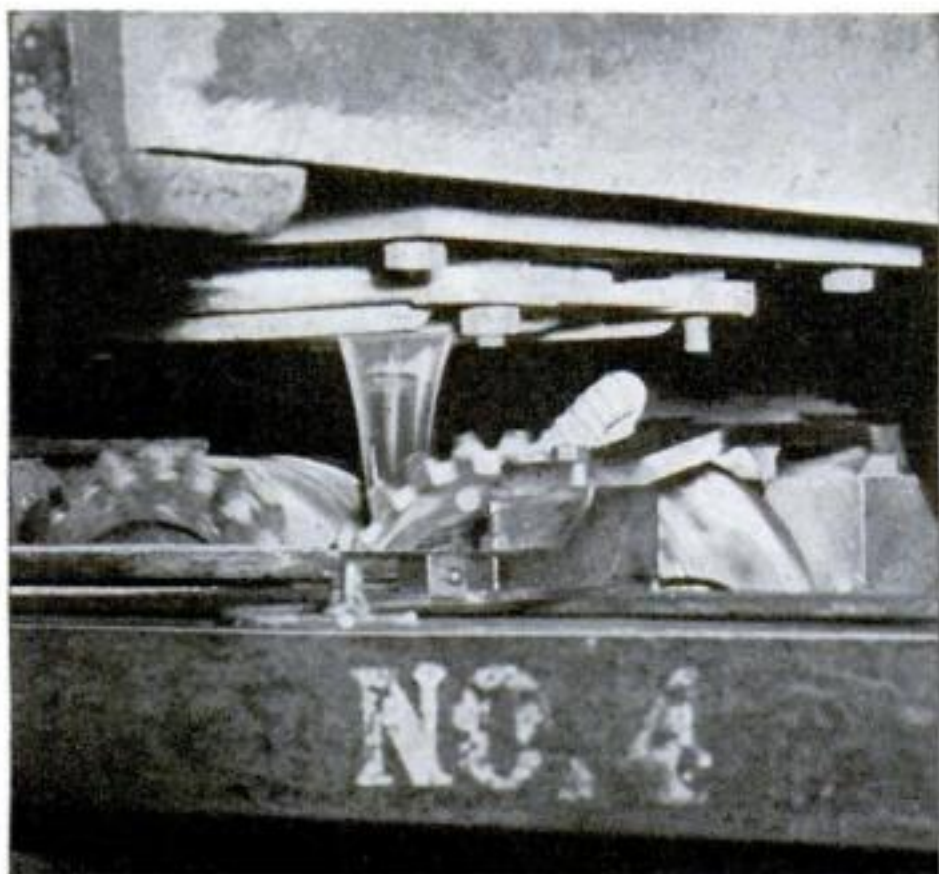




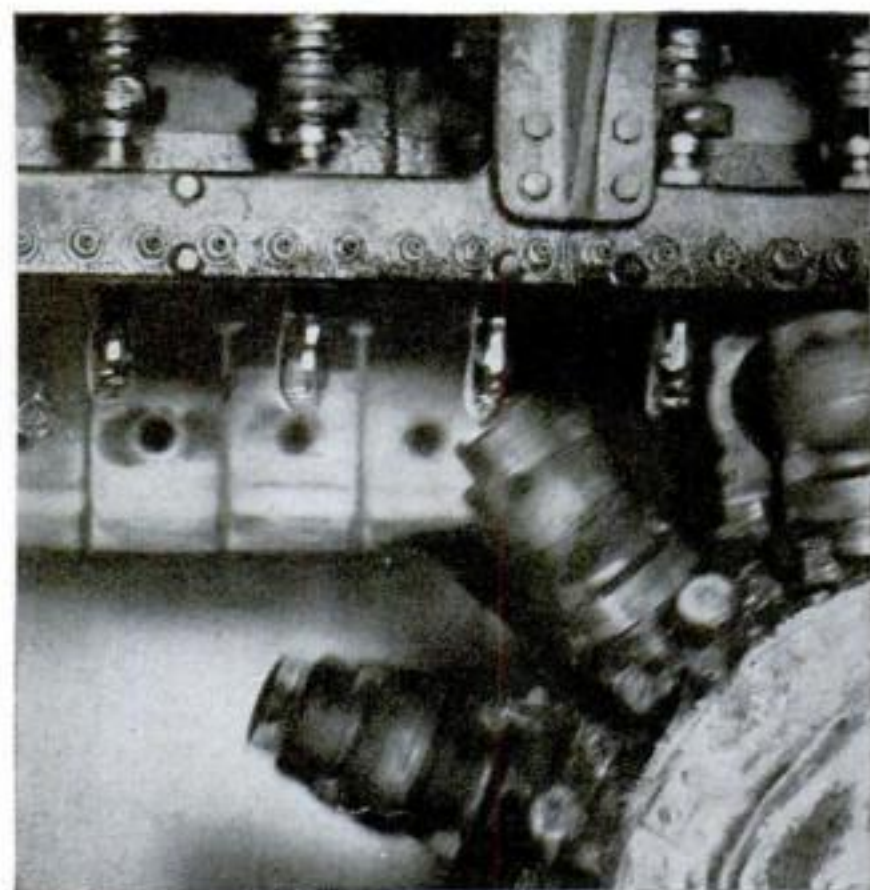
**5** Shielding his eyes from the blinding glare of the flames with a window of dark glass, a workman peers through an opening in the furnace, whose heat reproduces in miniature the conditions on the sun



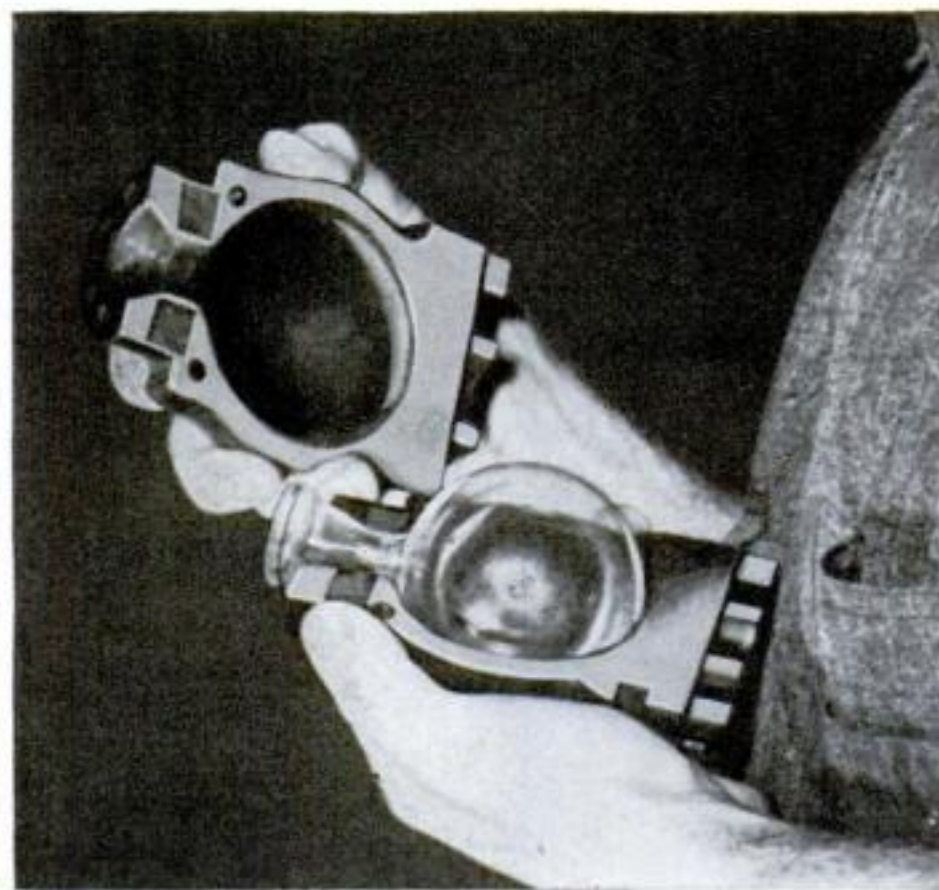
**6** Streaming from the furnace, molten glass enters the "ribbon machine," which carries it along between rollers like a moving ribbon. This machine is also used in the manufacture of electric-light bulbs



**7** As the ribbon goes along horizontally, clinging to the underside of a moving belt, puffs of compressed air blow through it from above to form bubbles that grow in size until each is plucked off between the halves of a mold moving up to meet it



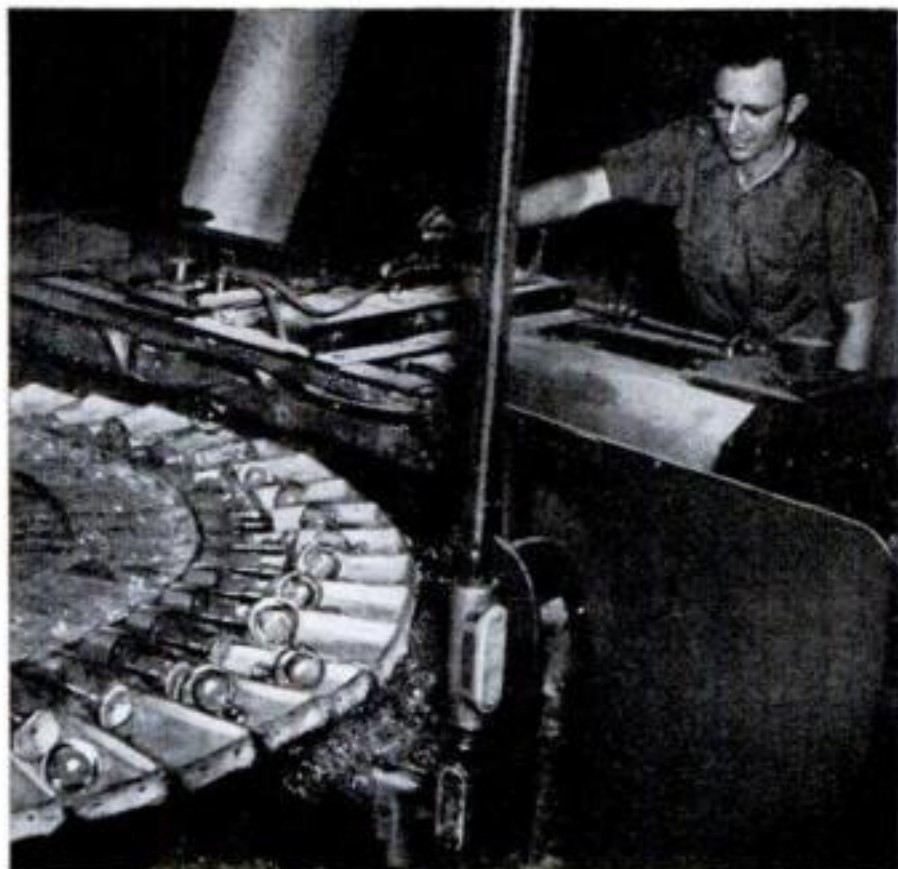
**8** Clamped inside the mold, the bubble of glass is blown up to the desired shape. In the picture below, one of the molds has been opened to show how the glass sphere is formed with its neck attached. Molds are changed to make ornaments of any type





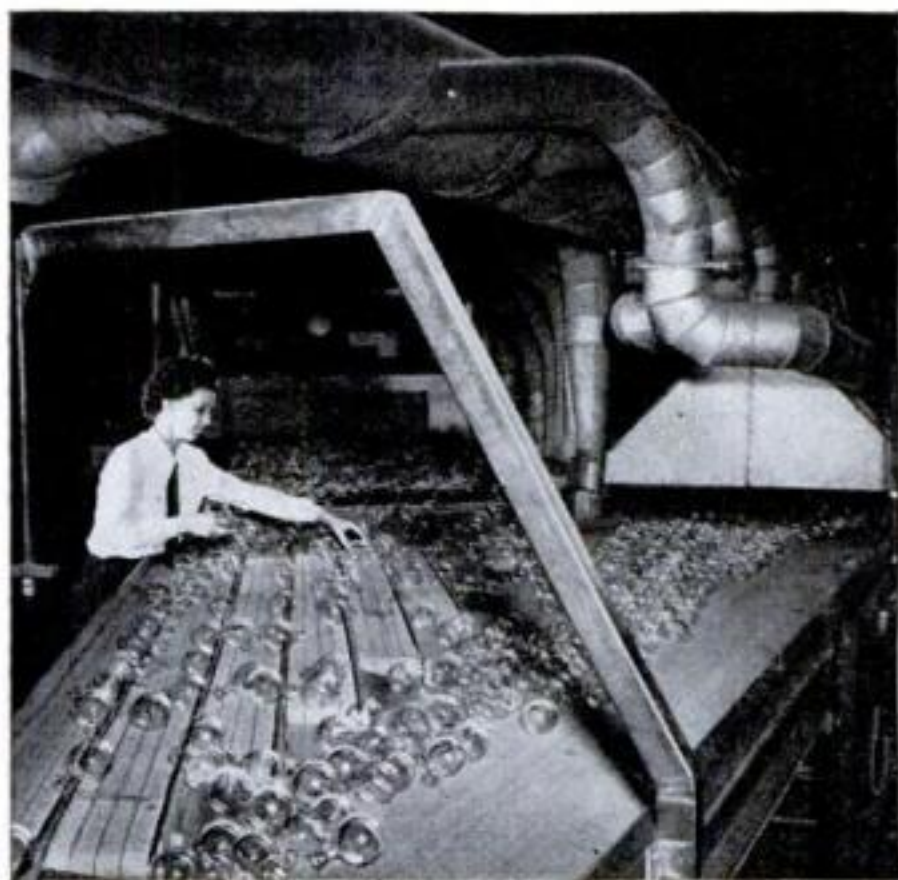
**9** Asbestos "hands" on this rotary transfer mechanism take the hot, shaped bulbs from the molds of the ribbon machine. Then, turning from a horizontal to a vertical position, they lay them on a belt . . .

**10** ... which carries them to the "lehr" for cooling. It takes the globes about twenty minutes to pass through this forty-foot machine, where the temperature is lowered gradually to prevent strains



**11** Emerging from the lehr, the bulbs are carried by a moving belt past girls who remove broken pieces. At this stage, the clear glass spheres resemble soap bubbles floating on a stream of water. A pound of glass makes thirty average-size globes

**12** These girl inspectors are examining the globes for imperfections. Modern machine methods used at the Corning plant not only permit greater speed of production, but also turn out stronger and much more uniform ornaments (CONTINUED)

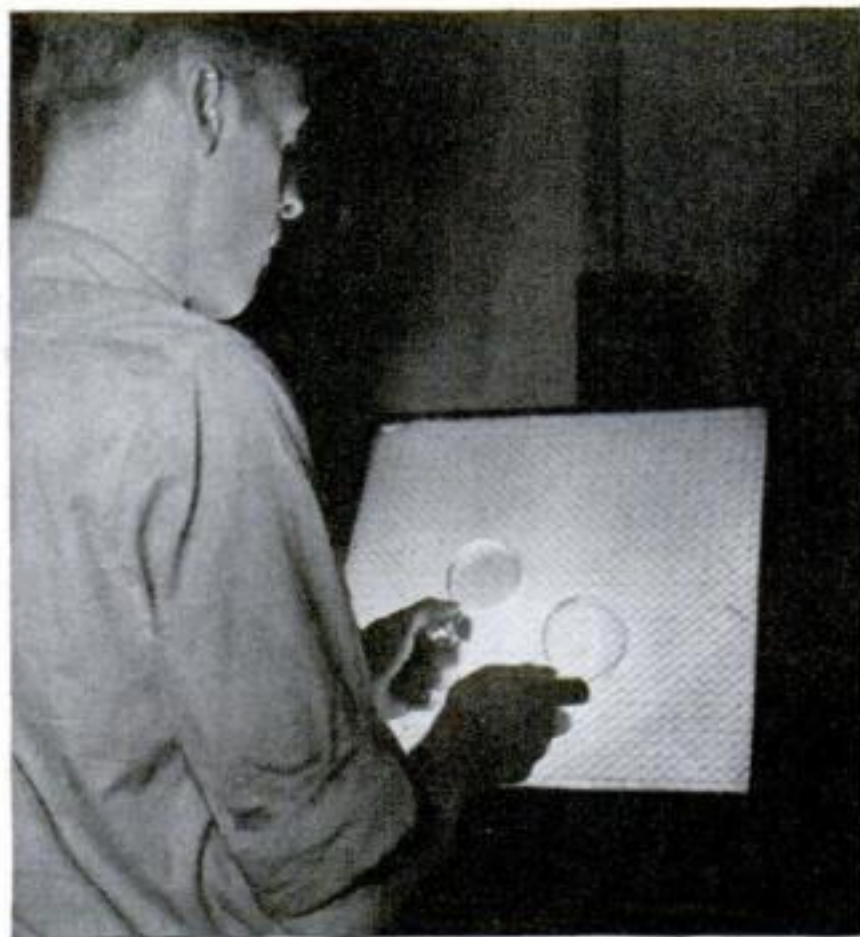






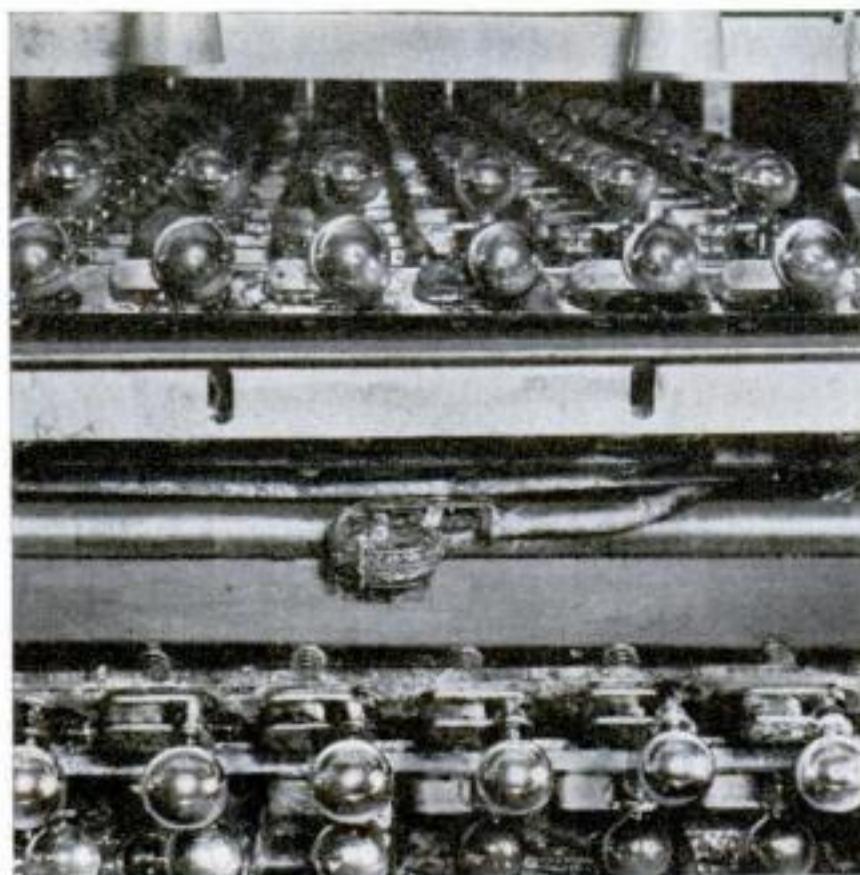
**13** Picking up bulbs at random from the moving belt, this inspector holds them against the polariscope, in which polarized light reveals any strains created in cooling

**14** Another type of polarized-light testing instrument is seen below. When a bulb is held up in front of the lighted screen, tell-tale iridescent patterns show lines of stress or tension which might make it break easily



**15** Here girls are putting the bulbs on racks in a machine for silvering and coloring. First, chemicals are sprayed up through the necks to give a mirrorlike surface inside . . .

**16** . . . then the racks pass through the dye vats where baths of brilliant color give them the outer tints of red, blue, green, gold, and silver that add sparkle to trees on Christmas Day





**17** After, the dye has been dried quickly by heat, the necks are cut off by an automatic machine. Occasionally, however, one of the bulbs gets by the machine. It is the job of this girl to catch such strays and cut off their necks by hand on a Carborundum wheel



**18** At the end of the long production line, the globes are sorted and broken ones are removed. Now they are packed in partitioned cardboard boxes

**19** Enough ornaments to cover a whole forest of Christmas trees are contained in these cartons stacked in a warehouse awaiting shipment. Two million are turned out every week







# Here's My Story



**1** CHEVALIER JACKSON WAS BORN IN PITTSBURGH IN 1865. WHEN ONLY A CHILD, HE BEGAN TO DEVELOP HIS WORLD-FAMOUS FINGER DEXTERITY BY ASSUMING THE FAMILY TASK OF TWISTING PAPER INTO LAMP LIGHTERS



**2** AT 12, YOUNG JACKSON DEvised A HARPOON BIT TO RECOVER DRILLING TOOLS LOST 1,500 FEET DOWN AN OIL WELL ON HIS FATHER'S LAND. THIS TOOL LATER BECAME WIDELY USED IN AMERICAN OIL FIELDS



**3** LATER, HE SAVED VALUABLE PAPERS DURING A PLANING-MILL FIRE, AND WAS REWARDED WITH ENOUGH PINE BOARDS TO MAKE A SAILING CANOE IN HIS FATHER'S HOME WORKSHOP, WHERE HE SPENT MUCH OF HIS TIME



**4** TO EARN MONEY FOR HIS FIRST YEAR AT JEFFERSON MEDICAL COLLEGE IN PHILADELPHIA, JACKSON PAINTED CHINAWARE. HE WORKED WITH A BRUSH IN EITHER HAND, TO DEVELOP AMBIDEXTERITY

**5**

HIS SECOND YEAR OF MEDICAL SCHOOL WAS PARTLY FINANCED BY MONEY HE EARNED AS COOK ON A COD-FISHING VOYAGE TO THE GRAND BANK OF NEWFOUNDLAND





# THE CAREER OF CHEVALIER JACKSON



**6** ON APRIL 2, 1886, HE RECEIVED HIS MEDICAL DEGREE AND BECAME DR. CHEVALIER JACKSON. YEARS LATER HE RETURNED TO THE COLLEGE AS A FACULTY MEMBER



**7** WHILE RETURNING IN STEERAGE FROM A MEDICAL-STUDY TRIP ABROAD, HE VOLUNTEERED TO CARE FOR A PASSENGER STRICKEN WITH DREADED SMALLPOX. LOCKED IN A QUARANTINE CABIN, JACKSON SAVED THE MAN'S LIFE



**8** ON HIS RETURN TO PITTSBURGH, WITH ONLY \$1.76 LEFT IN HIS POCKET, HE BEGAN THE PRACTICE OF MEDICINE. HE DECIDED TO SPECIALIZE IN THROAT AILMENTS



**9** IN 1890 HE DEVELOPED A DEVICE FOR EXAMINING THE HUMAN ESOPHAGUS. FROM THIS GREW HIS FAMOUS BRONCHOSCOPE, A MECHANISM FOR REMOVING FOREIGN OBJECTS ACCIDENTALLY LODGED IN THE LUNGS. FORMERLY, 98 OUT OF 100 PERSONS SO AFFLICTED, DIED



**10** IN 1928, HE TOOK CHARGE OF THE BRONCHOSCOPIC CLINIC AT THE GRADUATE SCHOOL OF MEDICINE IN PHILADELPHIA. HERE HE SAVED THE LIVES OF HUNDREDS OF PATIENTS, MANY OF THEM CHILDREN WHO HAD SWALLOWED COINS, PINS, OR OTHER OBJECTS



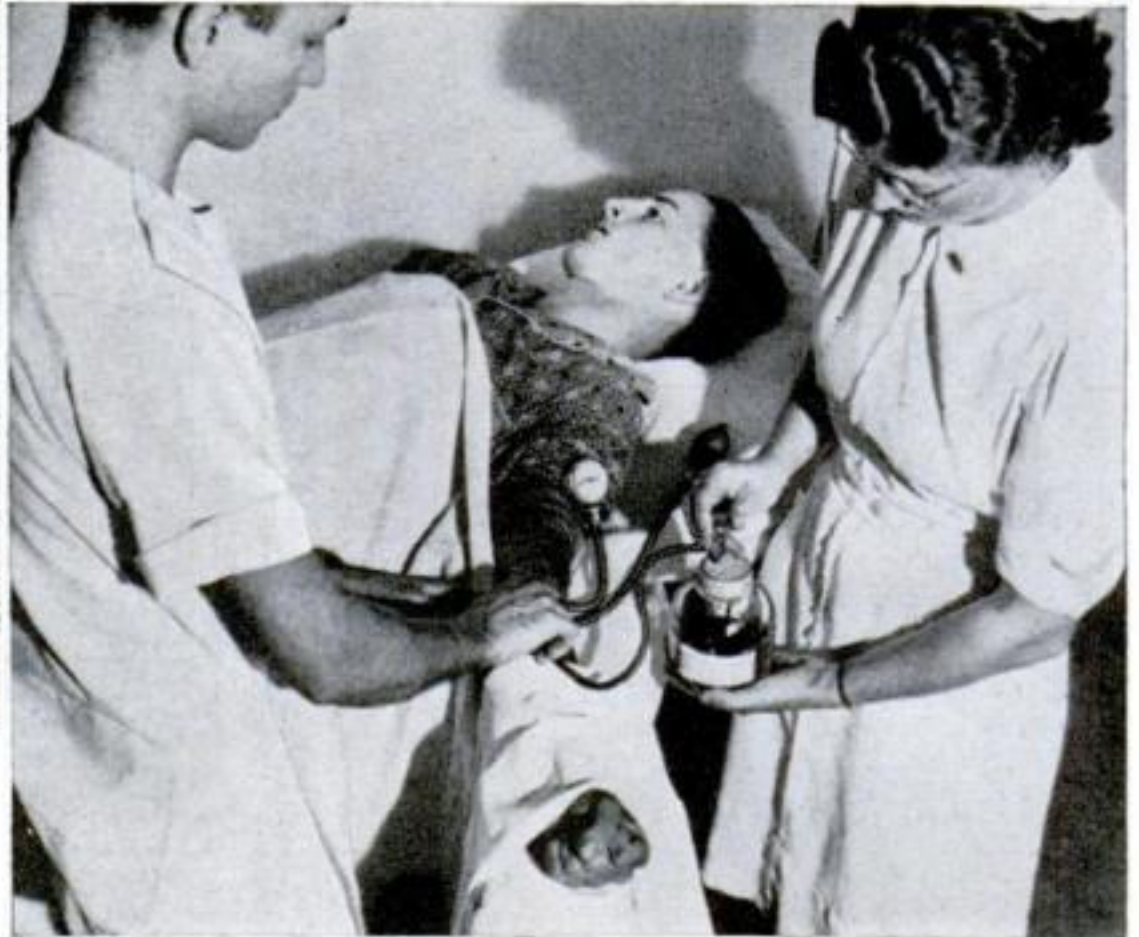
**11** FOR HIS MARVELOUS WORK, DR. JACKSON HAS BEEN SHOWERED WITH HONORS, INCLUDING DECORATIONS FROM FOREIGN GOVERNMENTS, AND HONORARY DEGREES FROM MANY AMERICAN UNIVERSITIES



## Blood for British War Victims Stored by American Red Cross

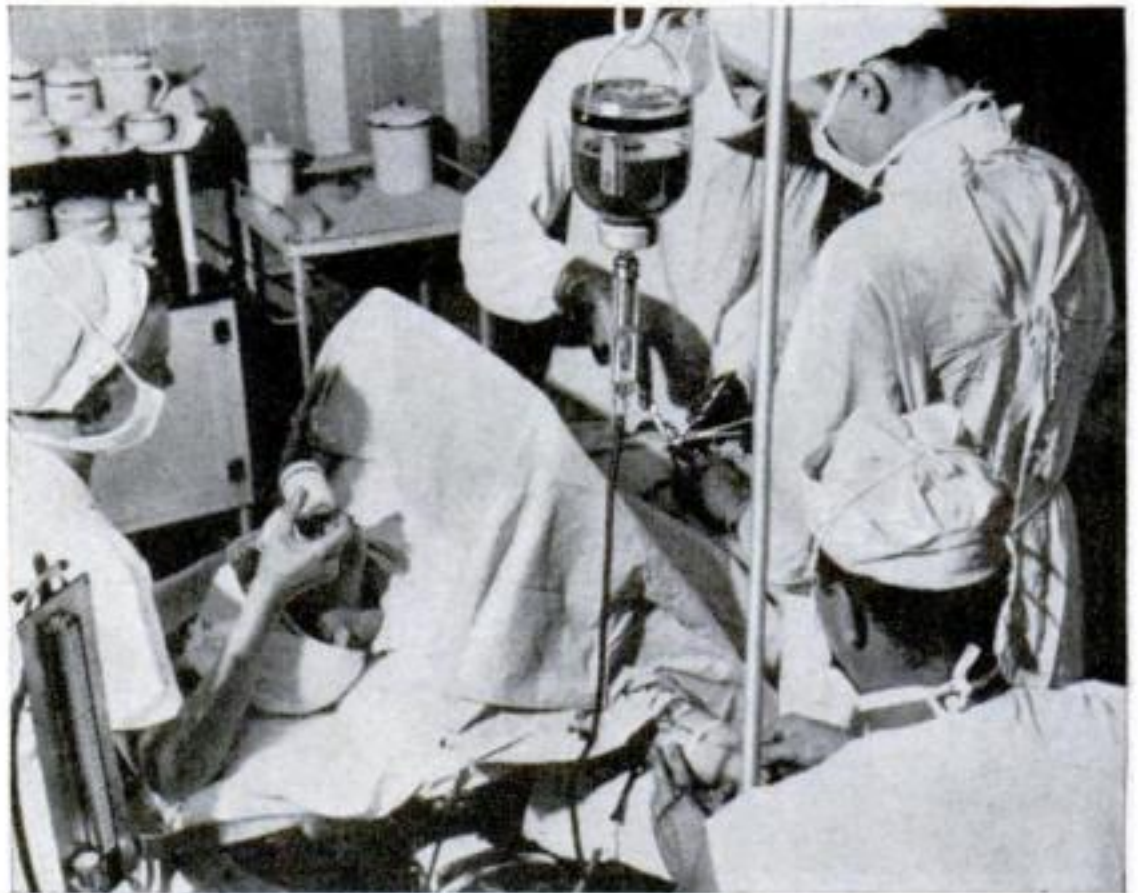


American blood for British war victims: Part of a shipment prepared for treatment of the wounded abroad



Draining blood from the veins of a volunteer donor. When the nurse opens a valve, the fluid is drawn into the vacuum bottle

**B**LOOD by the gallon taken from hundreds of volunteer donors in this country is now being processed under the direction of the American Red Cross for shipment to England and ultimate use in the treatment of war casualties. When a supply of blood is drained from the veins of a volunteer donor, it is bottled and stored in a refrigerator where it separates, the heavier corpuscles settling to the bottom and the plasma, or liquid, watery part of the blood, rising toward the top. Further separation is accomplished by whirling bottles of blood in a centrifuge at a rate of 2,000 revolutions a minute. The plasma is then drawn off and mixed with a saline solution. In this form, the blood plasma can be handled, shipped, or stored for long periods of time without impairing its beneficial effects when introduced into the blood stream of a person suffering from wound shock or hemorrhage. Another advantage is the fact that the plasma obtained from the blood of many donors can be mixed and is suitable for use with all persons, regardless of the type of blood they have, whereas with actual blood transfusions, care must be taken to see that the



How bottled blood is used during an operation. The doctor at lower right is ready to inject the plasma in the patient's arm

blood of the donor and that of the person who is to receive it are of the same type. The entire process of gathering, separating, and mixing the plasma is conducted under absolutely sterile conditions. In addition to this work, the Red Cross is laying plans for mobilizing blood donors into a nation-wide corps for service in any emergency.





Jan Norriss "making up" one of her mannequins. Note the lifelike appearance of the finished figure

## Mannequins of Rubber Have Flexible Bodies

FLEXIBLE mannequins that have an exceptionally lifelike skin texture are the result of an invention by Jan Norriss, New York City sculptress. Miss Norriss pours

a mixture of chemicals into liquid latex, and shapes the result in molds. It can be bent, twisted, and stretched, but will return instantly to its original shape. Scrubbing does not mar the surface in any way. Ideal for use in making mannequins, the material may also be used for making artificial limbs, and nurses in training are given arms made of the rubber substance on which to practice hypodermic-needle injections.

## "Electric" Paint Keeps Barnacles off Boat Hulls

BARNACLES are said to be repelled from the bottoms of ship hulls by a paint developed by Capt. J. Stanley Cameron, retired Yankee skipper now of Long Beach, Calif. According to the captain, his paint creates an electrical turbulence around the submerged portion of a vessel that discourages barnacles and other marine growths from attaching themselves to the hull.



Capt. J. Stanley Cameron explains how his paint discourages barnacles

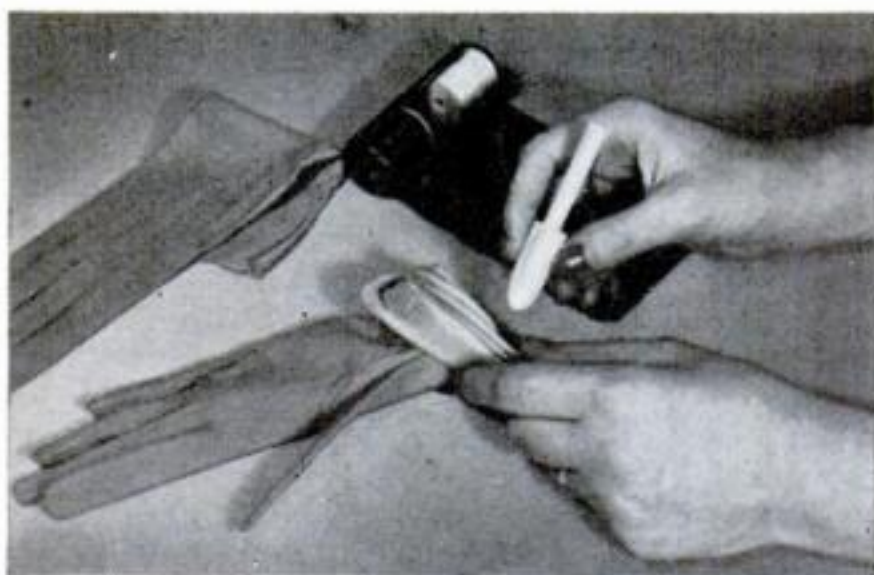


# APPLIANCES FOR



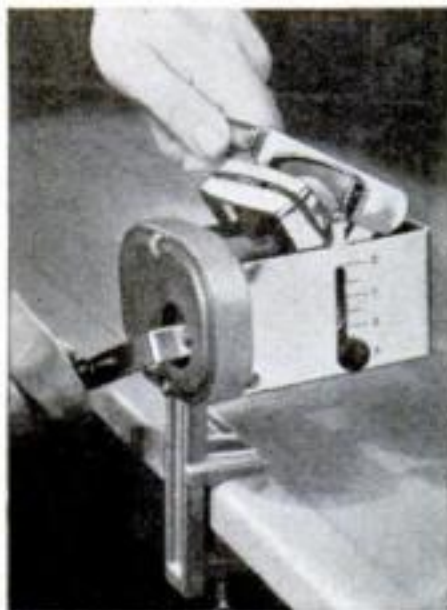
**HOUSEHOLD GLOVES** coated with Neoprene, a synthetic rubber product, are handy for dishwashing, cleaning, gardening, and many other tasks about the home. Water-resistant, they are said to be more comfortable than ordinary rubber gloves

**CLOTHESLINE HOOKS** of plastic material are supplied with an elastic rubber line designed for use indoors or while traveling. Shown below, the hooks hold the daintiest garments without injury



**DARNING EGG FOR GLOVES.** Mending a glove finger is simplified by the use of this "darning egg." Made of plastic, it comes in three colors

**METAL MIRROR.** Nobody can get seven years' bad luck by breaking the mirror below. It is made of sheet steel with nickel-chrome coating. Moist air does not harm it, so it can be used in the bathroom without rusting



## KNIFE SHARPENER IS ADJUSTABLE

By moving a button on the sharpener at the left, the blade rest is set at the proper angle for sharpening carving knives, paring knives, or table knives, as required



# THE HOUSEHOLD



**CANNON BEVERAGE MIXER.** Guests are sure to be amused by this novel beverage mixer, which resembles a miniature brass ship's cannon. Appropriate glasses have feet representing small cannon balls



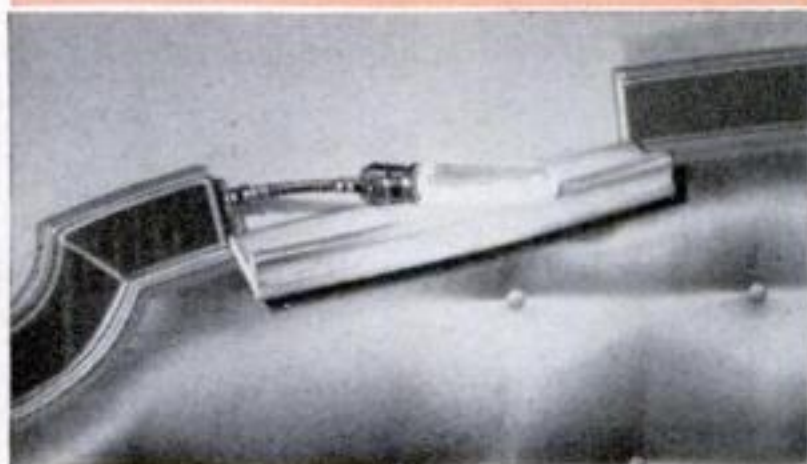
## BOTTLE STOPPER

For keeping "fizz" in opened bottles of carbonated drinks, the compact stopper at the left can be tightened or loosened by turning a winged lever at the top. A rubber disk on the inside seals the cap



**CORN ON THE COB** is served in style with this set consisting of two forks for spearing the ear, an earthenware pot and brush for butter, and a plate

**CONCEALED BED LIGHTS.** When a section of the mirror panel around the head of this bed is pulled down, it reveals a hidden reading lamp as seen below. On a flexible stem, the lamp can be adjusted





# America Starts Work on World's Biggest Navy

By ALDEN P. ARMAGNAC

**W**ITHIN four years the war fleet of the United States will be the mightiest armada the world has ever seen. Three hundred and thirty new ships, added to the present 348, will give us our long-awaited two-ocean navy, a fighting force capable of defending both coasts simultaneously.

The new warships—17 battleships, 48 cruisers, 12 aircraft carriers, 171 destroyers, and 82 submarines—will represent the last word in the evolution of fighting craft, and innovations among them may foreshadow the whole future of naval warfare.

Of the seventeen battleships, the first six will be of 35,000 tons and carry nine sixteen-inch guns apiece in their main batteries. They will be the biggest, most powerful, and speediest battleships we have ever built. Two of them, the *North Carolina* and *Washington*, have been launched and are due for completion in 1941. Keels have been laid for the rest—the *South Dakota*, *Indiana*, *Massachusetts*, and *Alabama*.

In appearance, their most striking feature will be their conical masts, rising like lighthouses to present a new silhouette against the sky. Cage masts, once typical of U. S. battleships, proved too unsteady for mounting precision fire-control instruments. Tripod masts, which superseded

them, were steadier and could have one or even two legs shot away—but fell with the loss of the third. More recently has appeared the bridge-and-tower structure, typified in our modernized *Idaho* and England's *Nelson*, whose tars have named it "Queen Anne's mansions" for its resemblance to a group of London flats. With the modern trend away from elaborate superstructure that an air bomb could turn into splinters of flying steel, styles for battleships have changed again, and the cone mast is the result. It houses fire-control apparatus that trains the big guns; a stubbier mast aft allows unobstructed anti-aircraft fire.

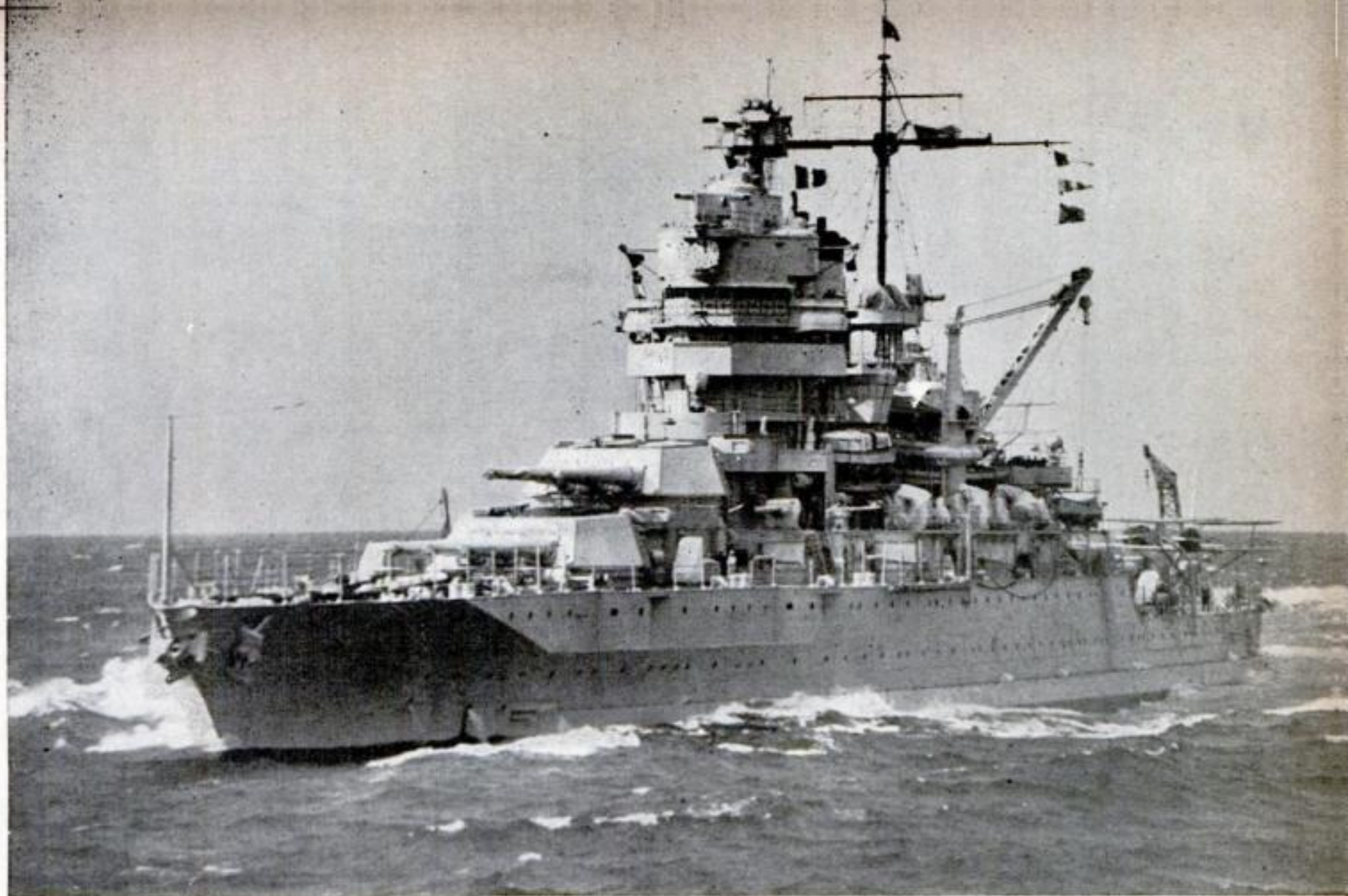
Even greater battleships are soon to come. The superdreadnought *Iowa* now building at the New York Navy Yard will be followed by the *New Jersey*, *Missouri*, *Wisconsin*, and seven more, all of 45,000 tons or larger. They will outclass at least four and probably eight battleships of 40,000 tons or more that Japan now is believed to be building.

First descriptions of the *Iowa*, *New Jersey*, and their sister ships indicate 45,000-ton size and an armament of nine sixteen-inch guns, the same as for the smaller *North Carolina* class. The difference in tonnage would be used to increase the speed of the larger ships. But plans for later battleships of the program, at least, may be revised. Recent Navy studies favor increas-



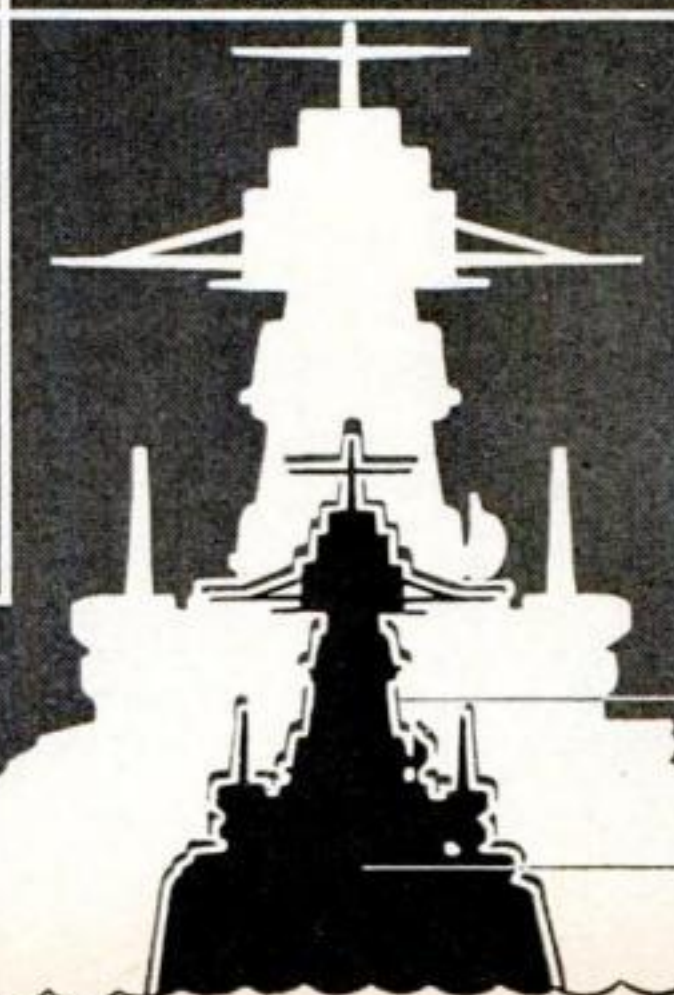
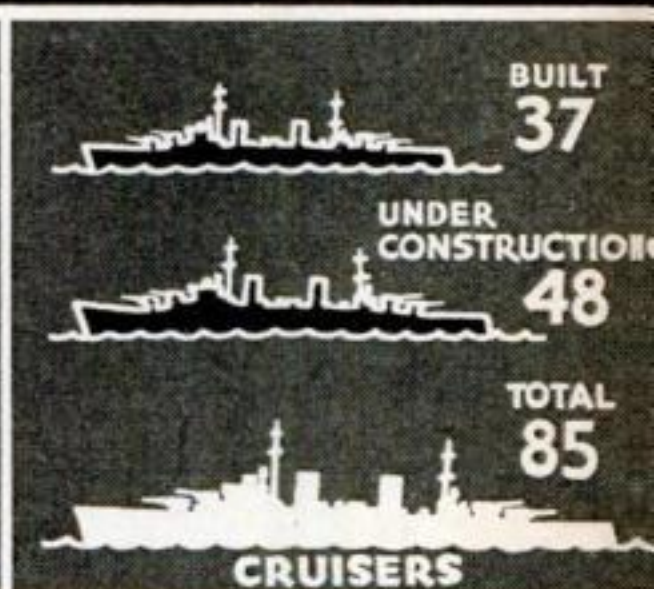
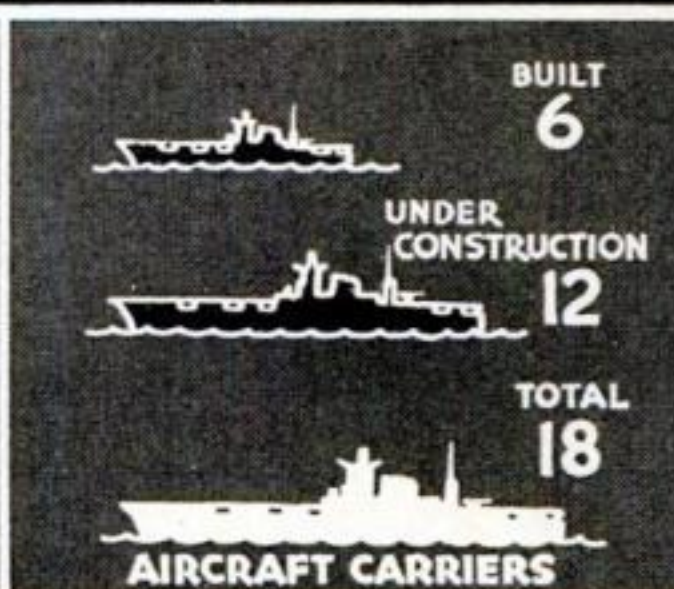
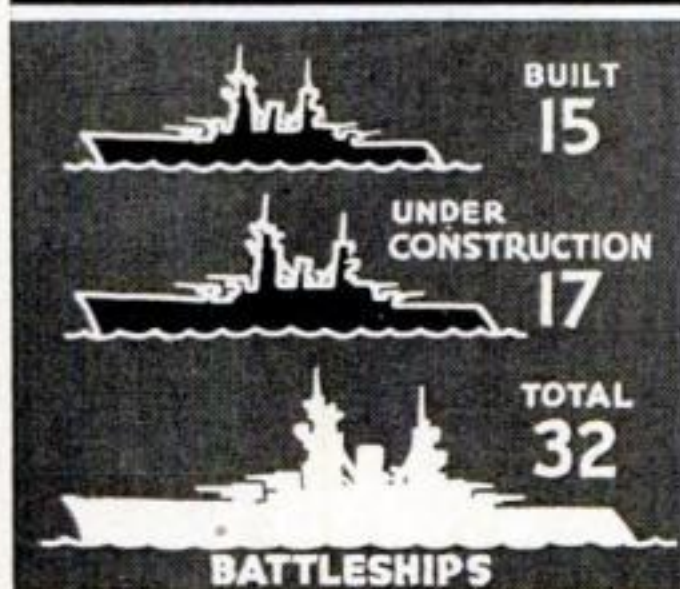
Sleek new destroyers like the *Wilson* are going into service as much as seven months ahead of schedule





Modernizing of older ships is a part of the program. Here the *Idaho* shows her "bridge-and-tower" foremast

## 330 NEW FIGHTING SHIPS WILL ASSURE TWO-OCEAN SUPREMACY



**678** FIGHTING SHIPS FOR  
**TWO-OCEAN  
NAVY**

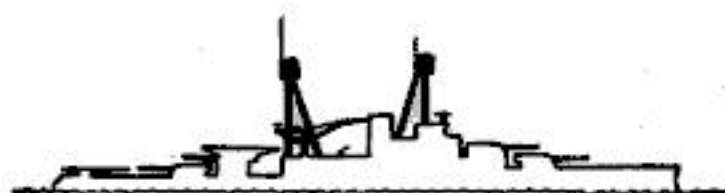
**348** BUILT  
**330** UNDER  
CONSTRUCTION



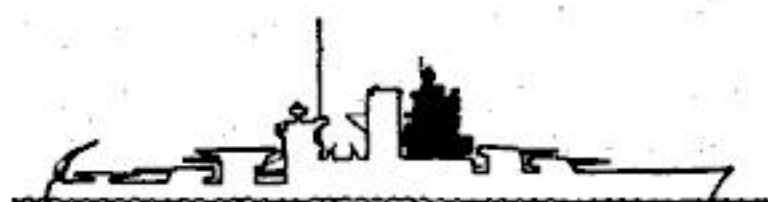
## CHANGING STYLES IN U.S. BATTLESHIPS



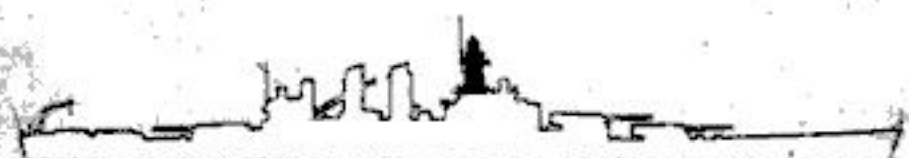
CAGE MAST (1915)



TRIPOD MAST (1929)



BRIDGE AND TOWER MAST (1934)



CONE MAST (1940)

Evolution of the mast since 1915 has tended toward types that are less vulnerable to shellfire and bombing. Above are shown, from top to bottom, the *Nevada* before modernization; the same ship as rebuilt in 1929; the *Idaho* after modernization in 1934; and the big, new *North Carolina*

ing the monster size of these floating fortresses to 50,000 or 52,000 tons, with perhaps twelve big guns. Also, it recently has been revealed that the Navy is experimenting with an eighteen-inch gun, the most powerful in the world. Proving-ground tests will determine whether it may be adopted for use on our biggest ships.

Twelve aircraft carriers in our two-ocean naval program will benefit from our experience with a wide variety of types. "The bigger, the better" doesn't seem to hold true for vessels of this category. Carriers are admittedly the most vulnerable of warships, and naval circles believe that the big, 33,000-ton *Lexington* and *Saratoga* carry "too many eggs in one basket" for comfort. Conversely, the 14,700-ton *Wasp*, which used up the tonnage allowed us for carriers in a treaty now expired, is regarded as smaller than the ideal size.

So the *Hornet*, *Essex*, *Bon Homme Richard*, *Intrepid*, *Kearsarge*, and seven more of our new carriers are expected to be patterned more nearly after the 20,000-ton *Yorktown* and *Enterprise*, completed in 1938. These highly satisfactory craft can carry 100 planes apiece, and are credited with the high speed of more than thirty-two

knots. To save time in bringing aircraft up to the flight deck in an elevator, some can be launched by catapult from the hangar deck below. Despite the claims of speed upon tonnage, enough weight is left over to provide light armor, and also torpedo protection—an advantage emphasized by the torpedoing and sinking of the British carrier *Courageous*.

New cruisers will include many sizes and types. One of the most interesting is a new 6,000-ton design, smallest built for the U. S. Navy in many years. Exceptionally speedy and economical, these ships should prove ideal for convoying and patrolling shipping lanes. Four of them, the *Atlanta*, *Juneau*, *San Juan*, and *San Diego*, were laid down in 1940. At the other end of the size range, we may expect enlarged editions of the 10,000-tonners we have been building, whose latest examples are the eight-inch-gun *Wichita* and the six-inch-gun *Helena*.

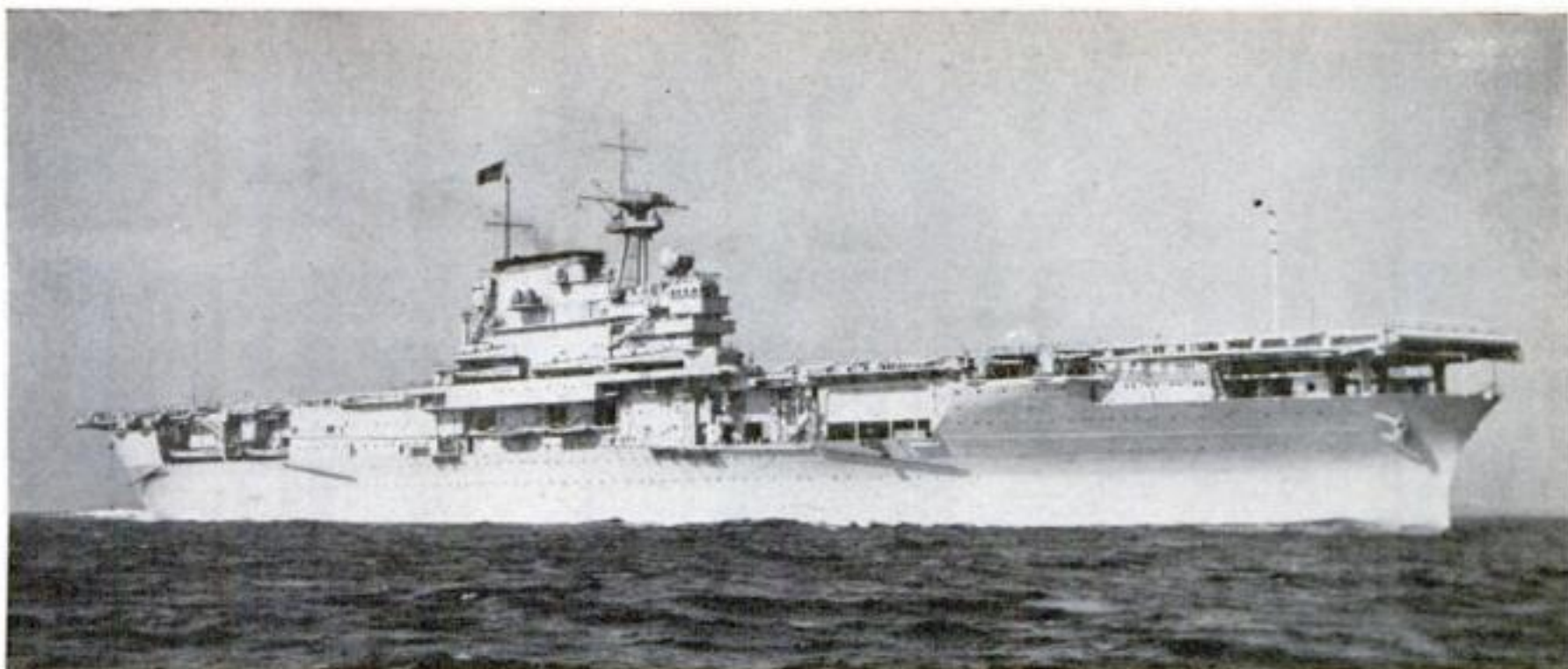
A total of 171 destroyers in the current building program will replace, many times over, the fifty old ones that were traded to Britain for invaluable naval bases. Among the latest in service, the largest can fire the world's heaviest torpedo salvo to either beam from their twelve deck-mounted tubes. U. S. destroyers now better

forty knots, zigzag with incredible responsiveness to a touch on their electro-hydraulic steering controls, and come to a "crash stop" from full speed ahead in less than three times their own length. Similar or better performance may be expected of the ones under construction, which are likely to follow a world-wide trend toward larger dimensions—constantly narrowing the distinction between destroyers and small cruisers.

Most of eighty-two submarines now contracted for, will be of the "fleet type" of about 1,500 tons, capable of extended ocean cruises either with the battle force or as lone commerce raiders. Orders also include, however, a new type of only 800 tons which would be used for coastal patrol.

OVER and above these 330 fighting ships of the principal naval categories, we are building a host of minor warships and auxiliaries, scarcely less essential. Under construction at the Philadelphia Navy Yard, the 6,000-ton U. S. S. *Terror* will be our first mine layer specifically designed for the purpose. In the last war, merchant ships were acquired and converted into mine layers. Other items on the Navy's shopping list include "mother ships" for destroyers and sub-





Model for new aircraft carriers is the *Yorktown*. She launches planes from both catapults and deck

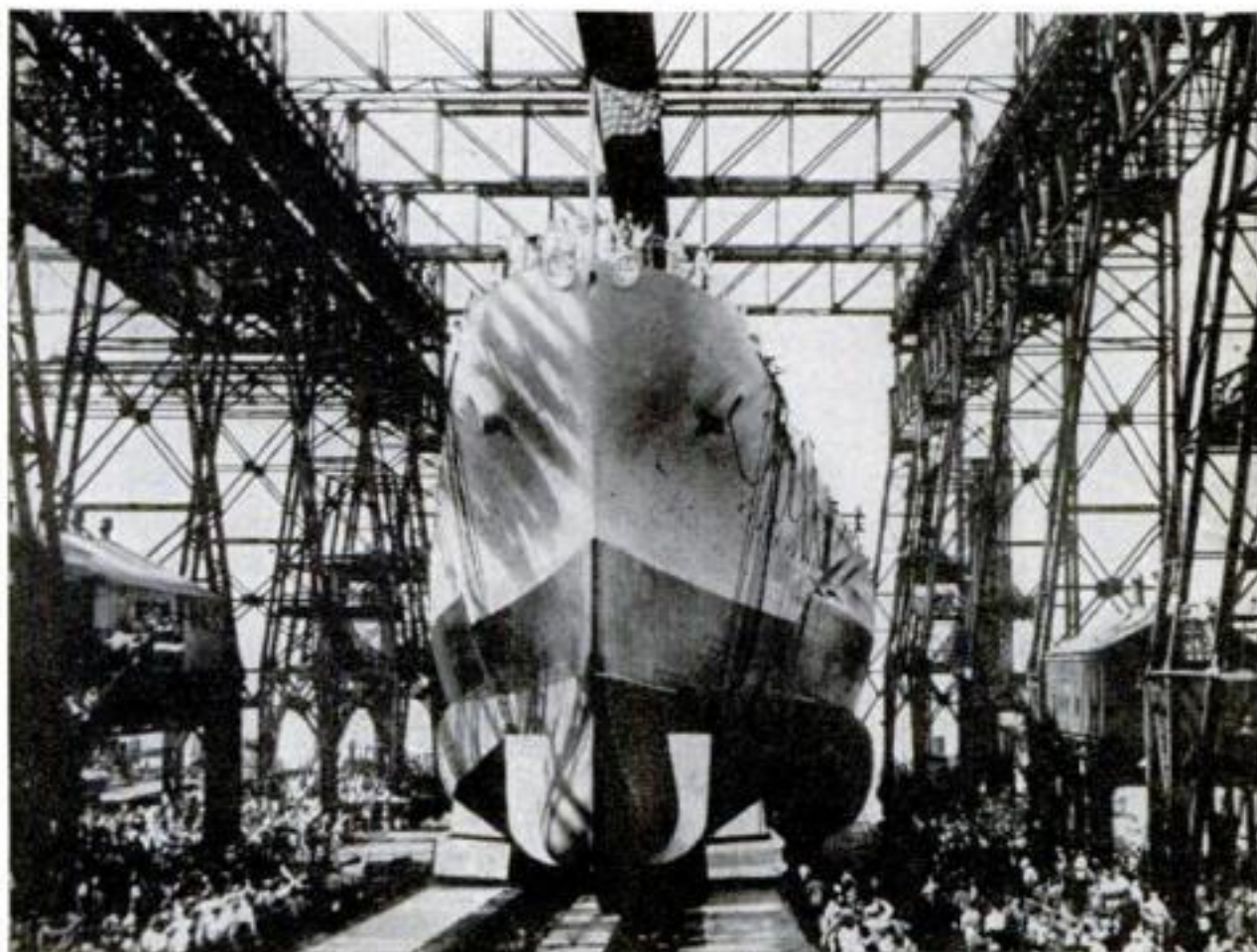
marines, armed landing boats to ferry men and thirty-mile-an-hour tanks ashore on a beach, a mosquito fleet of sub chasers and motor torpedo boats, and ships to lay and tend antisubmarine nets at naval and commercial harbors.

**W**HEN will the Two-Ocean Navy be completed? Normally it takes four years or more to build a battleship, three years for an aircraft carrier or cruiser, and two years for a destroyer or submarine. Also, all the country's shipyards lack capacity to handle at once the vast order they have received. But erecting new shipbuilding ways, and adding extra shifts of workers, toiling at night under the glare of floodlights, is speeding up the program almost to wartime pace. Originally it was expected to be finished by 1946, but Admiral Harold R. Stark, Chief of Naval Operations, now predicts that at least the bulk of the ships will be ready by 1944.

To take care of whatever may happen in the meantime, the Navy is making the most of every available craft, new and old. Pending completion of the new naval air base at San Juan, in Puerto Rico, the ancient and demilitarized battleship *Wyoming* has been restored to duty as a tender for long-range patrol planes. Many private

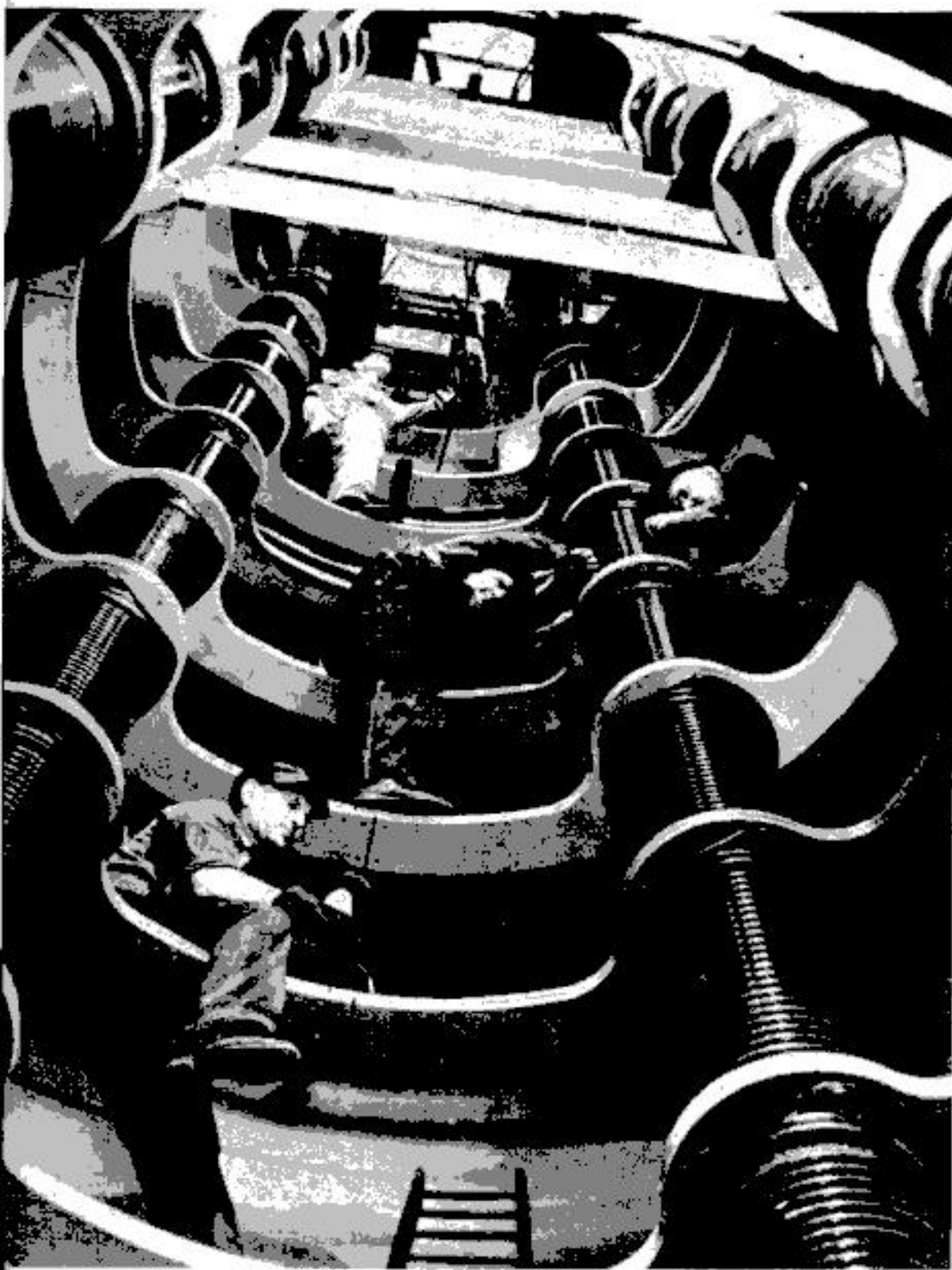
yachts, sold or presented to the Navy by their owners, are being refitted as patrol vessels. Thirty-six old submarines are being put back into service. Recommissioned destroyers have been converted into "aircraft destroyers" and speedy troop transports.

Thus, ready to meet any emergency, the fleet stands guard—constantly reinforced as the new fighting ships come sliding down the ways. We shall not have to wait until 1944, or any other year, to see a fleet of warships handed over to the Navy at one grand stroke. More and more often, we shall see those little headlines about a new submarine launched, or a destroyer commissioned. Each one serves as a reminder that our Two-Ocean Navy is already materializing before our eyes.



Latest developments in naval design appear in the *North Carolina* here being launched. Note the bulbous bow and anti-torpedo bulges at sides





Inside a 65-foot atom smasher. From "Science Picture Parade"

## Story of Science Told in Pictures

A KALEIDOSCOPIC outline of science, from archeology and atom smashers to weather and war, is presented in graphic form in "Science Picture Parade" by Watson Davis, director of Science Service and editor of "Science News Letter." With 302 photographs from the files of the service, brief chapter introductions and clearly written captions, Davis outlines the progress and knowledge of the earth's inhabitants since prehistoric days.

Though the chapter on war contains photographs of war machines and the men behind the machines, the book is free from horror pictures. It is in itself a tribute to the science of photography, for without modern cameras and films, many of the illustrations in the book, such as those splitting a lightning flash into its component parts, and stopping the wings of an insect in flight, would be impossible. Speaking of insects, Davis notes that the mosquito is rated as No. 1 insect enemy of man in the United States, doing an estimated \$145,000,000 worth of damage yearly. The boll weevil accounts for \$121,000,000 damages annually. (Price, \$3.)

## Books Show How Houses Are Built, Sails Are Made

**THIS IS THE WAY WE BUILD A HOUSE**, by Creighton Peet, is addressed directly to young readers, but it should find an enthusiastic audience among older persons who are not too sure they know the difference between rafters and joists, and would be hard put to answer Junior's embarrassing questions. In words and pictures, the book follows the growth of a house from the first steps of digging the cellar to the final stages of its finishing touches. Some idea of the way in which the author treats his subject may be gained from the text beneath one picture showing Billy and Tommy examining a jagged-edge hole in the rough flooring of their unfinished house. "... Billy and his kid brother saw that they had left a jagged, uneven hole where the inside cellar stairs were to go. Tommy asked why they did this, and Billy said he guessed they would saw

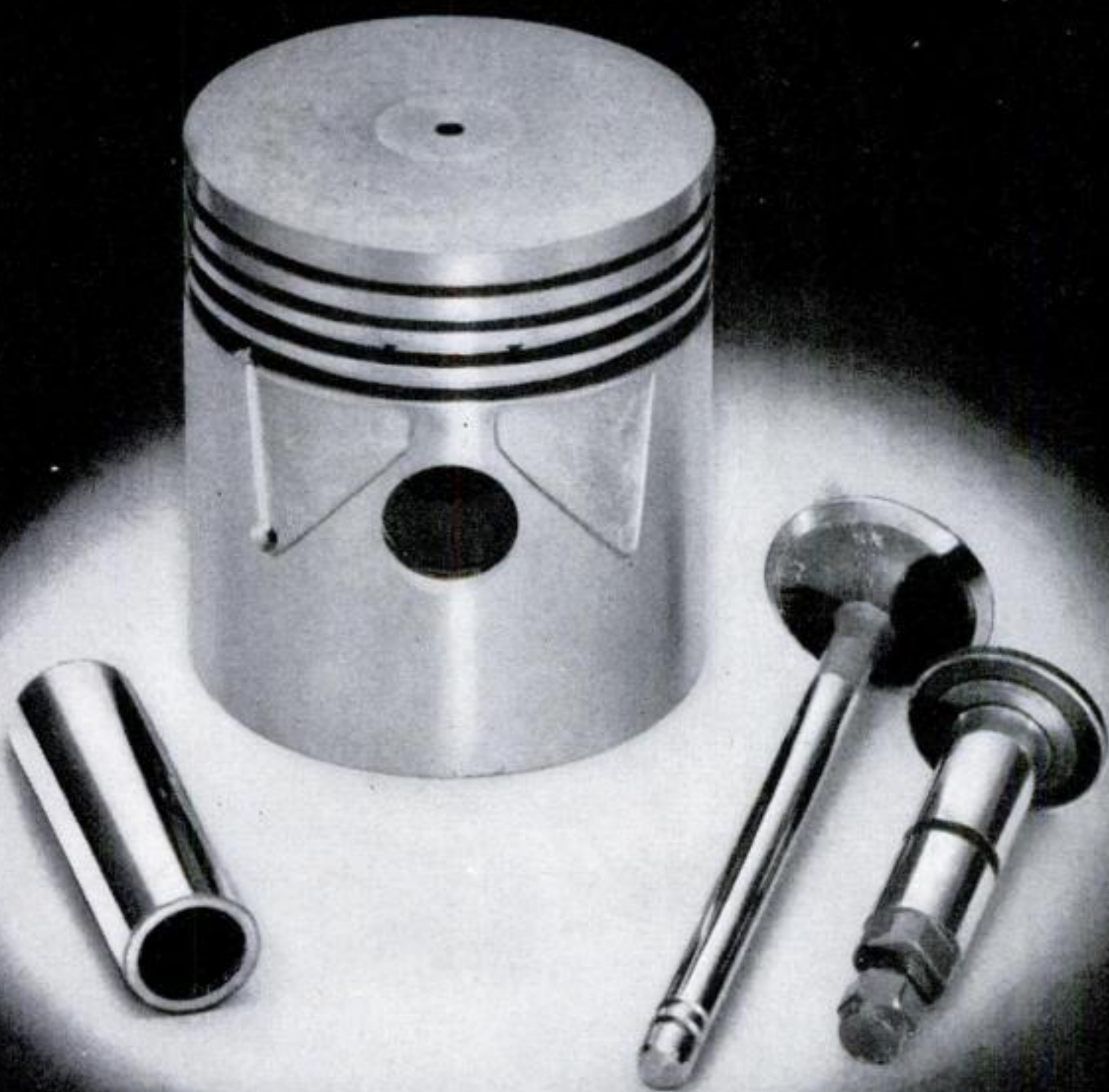
the ends off and make a smooth hole when they were ready to put the stairs in. They found out later that stairs are almost always built in a lumber mill and brought to the house in sections." (Price, \$2.)

**SAILMAKING SIMPLIFIED**, by Alan Gray. For years, professional sailmakers have kept their methods of cutting, shaping, and sewing sails a dark secret. But now, according to the publishers, the secrets are fully revealed in this 134-page volume, addressed to the thousands of men and women who count sailing their hobby. Tables, charts, diagrams, and photographs supplement the text. (Price, \$2.25.)

*If your bookseller cannot supply the book you want, send your order with remittance to Book Department, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York City.*



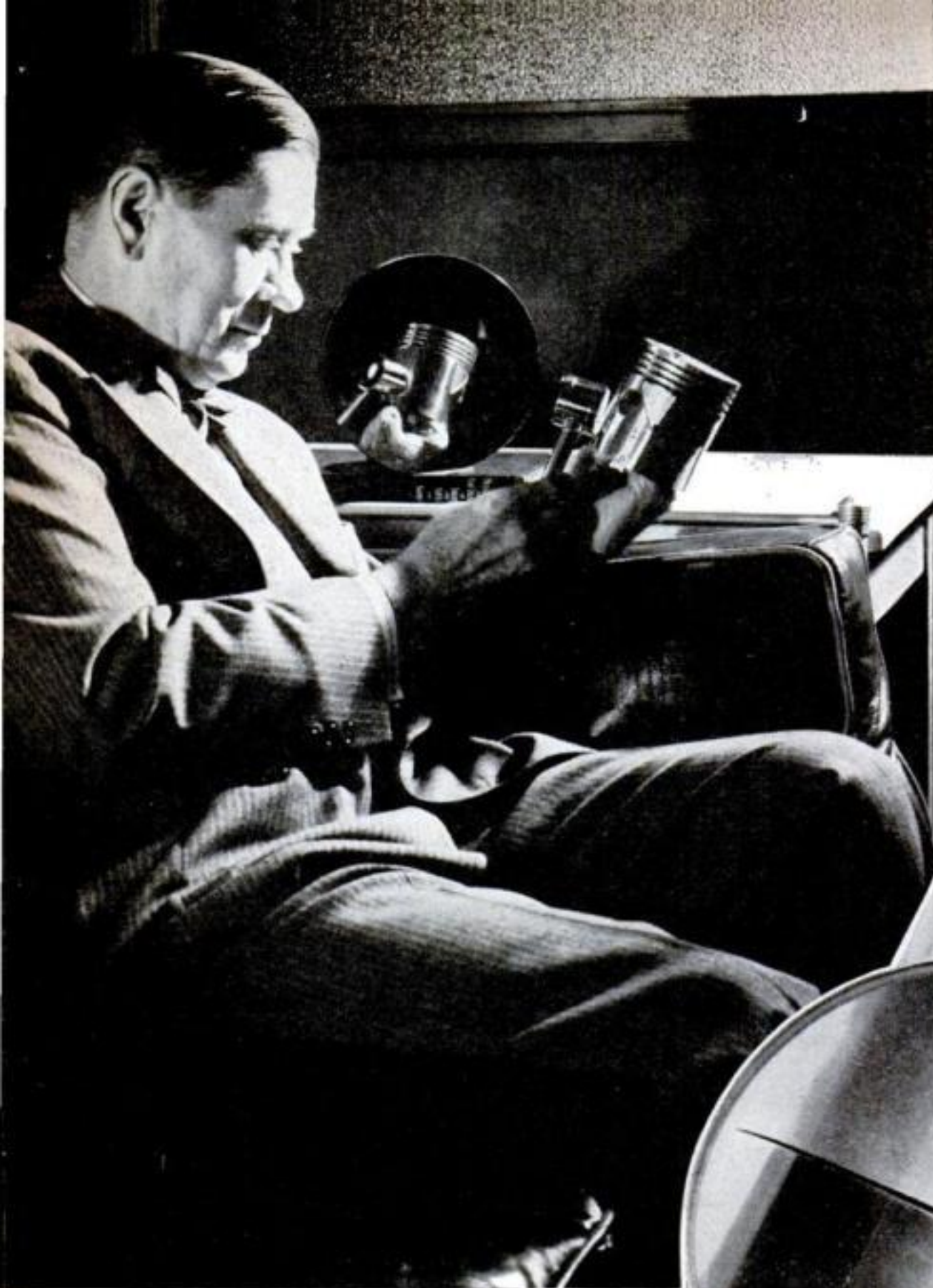
# AUTOS



Science's latest weapon in the war  
on friction—SUPERFINISH PARTS

next page





# Superfinish BEARINGS

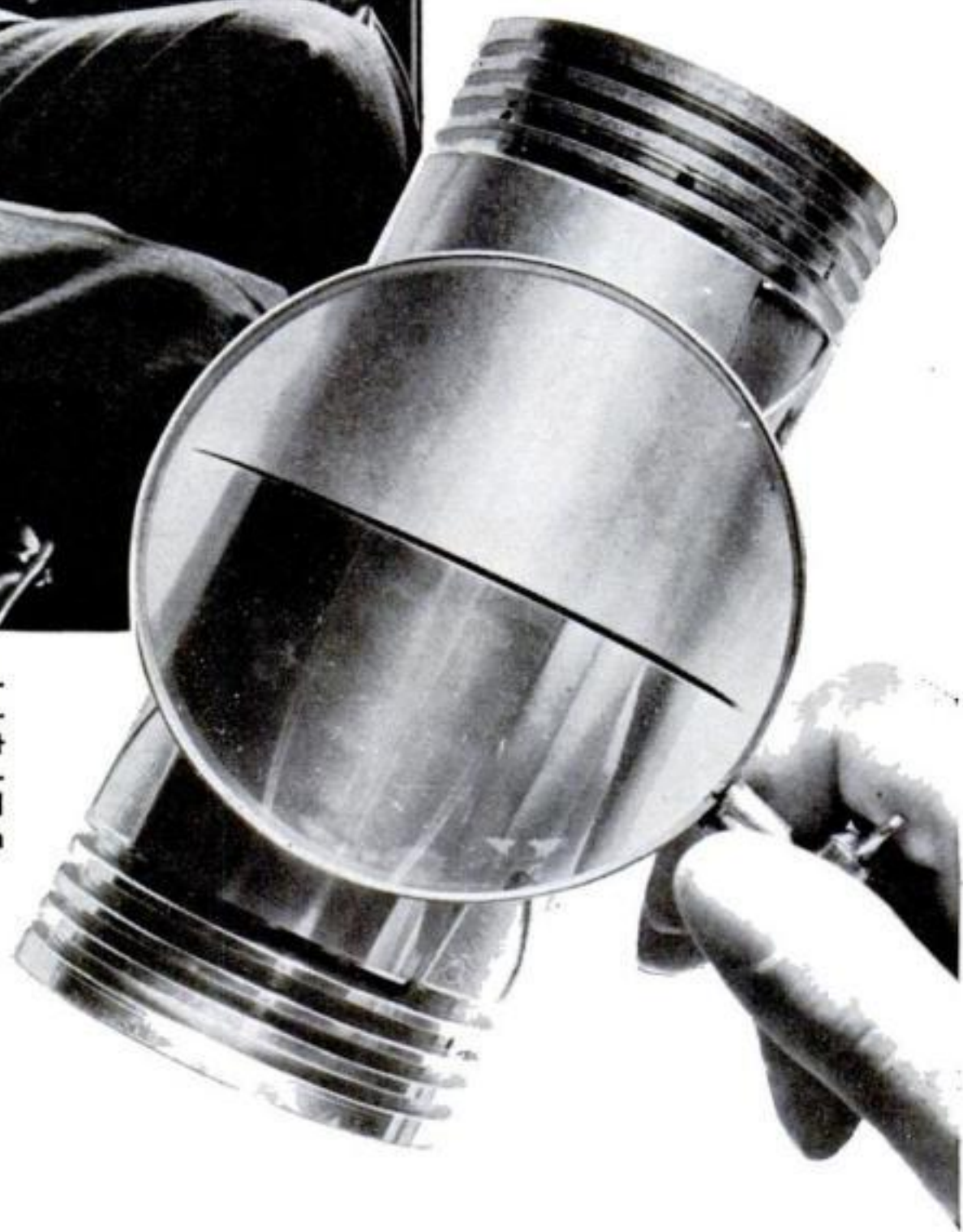
FOR  
Better Cars

• • •  
By S. Van Duyne

David A. Wallace, who developed the new method of finishing bearing surfaces. At right, a Superfinished piston (at bottom) is compared with one of ordinary finish

**T**HANKS to a make-shift bit of machinery, which conquered a task engineers long thought could be done right only by hand, today's buyers of automobiles and a long list of other machines are getting smoother and more economical performance from their purchases than ever before.

That device duplicated, during the finishing of certain metal surfaces, the random motion and the light pressure exercised by a skillful man in the laborious and costly process of hand lapping. Its success makes it possible to give that same hand-finished excellence to bearing surfaces on a mass-



production basis. That's why the chances are good now that the car you drive has Superfinished bearing surfaces in it somewhere.

It all started five years ago when new automobiles from the Chrysler plant turned up in railroad freight cars on the West Coast with damaged rear-wheel bearings.



Dealers squawked, of course. Trouble shooters from the company's great Jefferson Avenue plant in Detroit got on the job. They learned that the incessant pounding of freight car wheels over rail joints and switches was to blame, and that no manner of blocking up the automobile wheels lessened the damage. They discovered that under that pounding from the rails the hard, antifriction rollers on which the wheels of automobiles rest were hammering dents into their roller cups, or bearing "races." This caused a bothersome grinding noise when the cars were in motion, and it brought the necessity of replacing all damaged bearings.

The job of licking the problem fell to David A. Wallace, president of the Chrysler Division of the Chrysler Corporation. In his laboratories, microscopes showed that the dented cups were "brinelled," a condition resulting when any hard, round surface is forced against a softer one. But the microscopes also revealed a metallic fuzz on the entire surface of every cup, left there by the grinding wheels that originally finished them.

Wallace reasoned that it was this fuzz that broke down under the abnormal stresses of freight-car travel. He knew that hand lapping removed this fuzz. He proved his

point by installing hand-lapped cups in some wheels. When automobiles so equipped were shipped to California by rail, the cups were as good as new on arrival.

But slow, expensive hand lapping of every bearing was out of the question. And so Wallace rigged up something new out of an old drill press and a few abrasive stones.

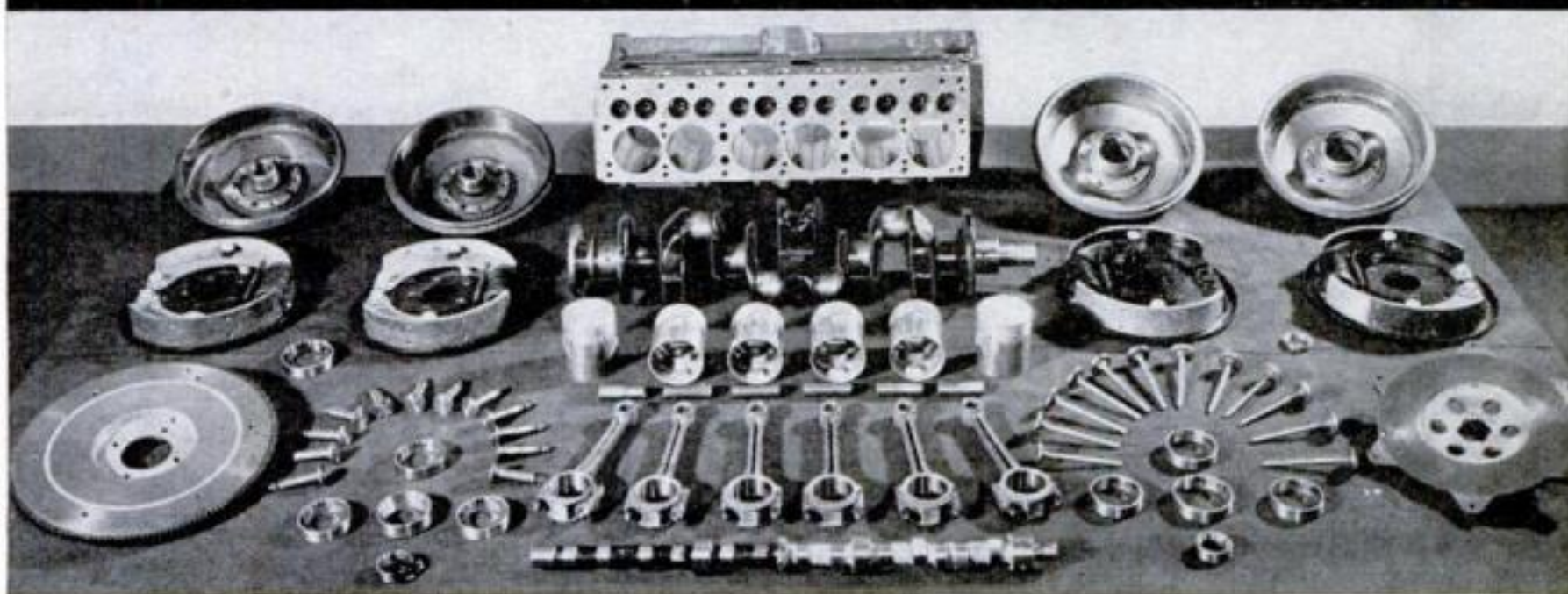
To help understand its action, Wallace compares it with the operation of finishing machines used on jobs that do not require Superfinished precision. They were, mainly, "turning" and "grinding" machines.

Turning means that the bearing or other object being worked on is revolved at high speed and pressure against the tip of a sharp cutting tool which slowly advances across it, shaving it down to the desired size. It leaves grooves like those on a phonograph record. Grinding is similar, except that in place of the sharp tool, a rapidly turning abrasive wheel is pressed against the rotating work. This also leaves grooves, although they are barely visible. Grinding is conventionally applied to already turned surfaces.

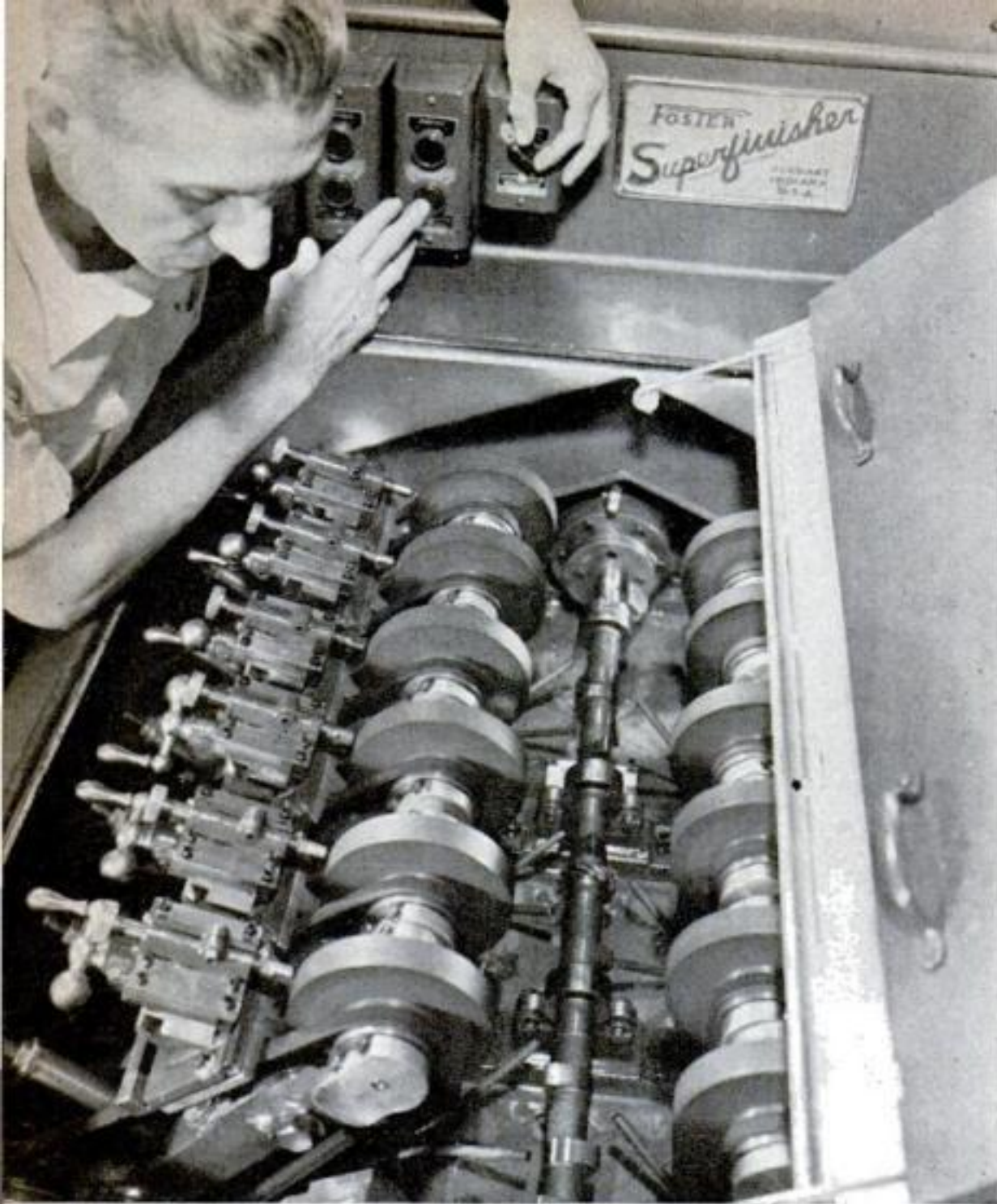
But the high speed and pressure of both turning and grinding generate heat from friction so intense—often reaching 2,000 degrees F.—that even quantities of cooling liquid cannot reduce it below the softening

How Superfinish compares in method and results with the work done by ordinary finishing machines

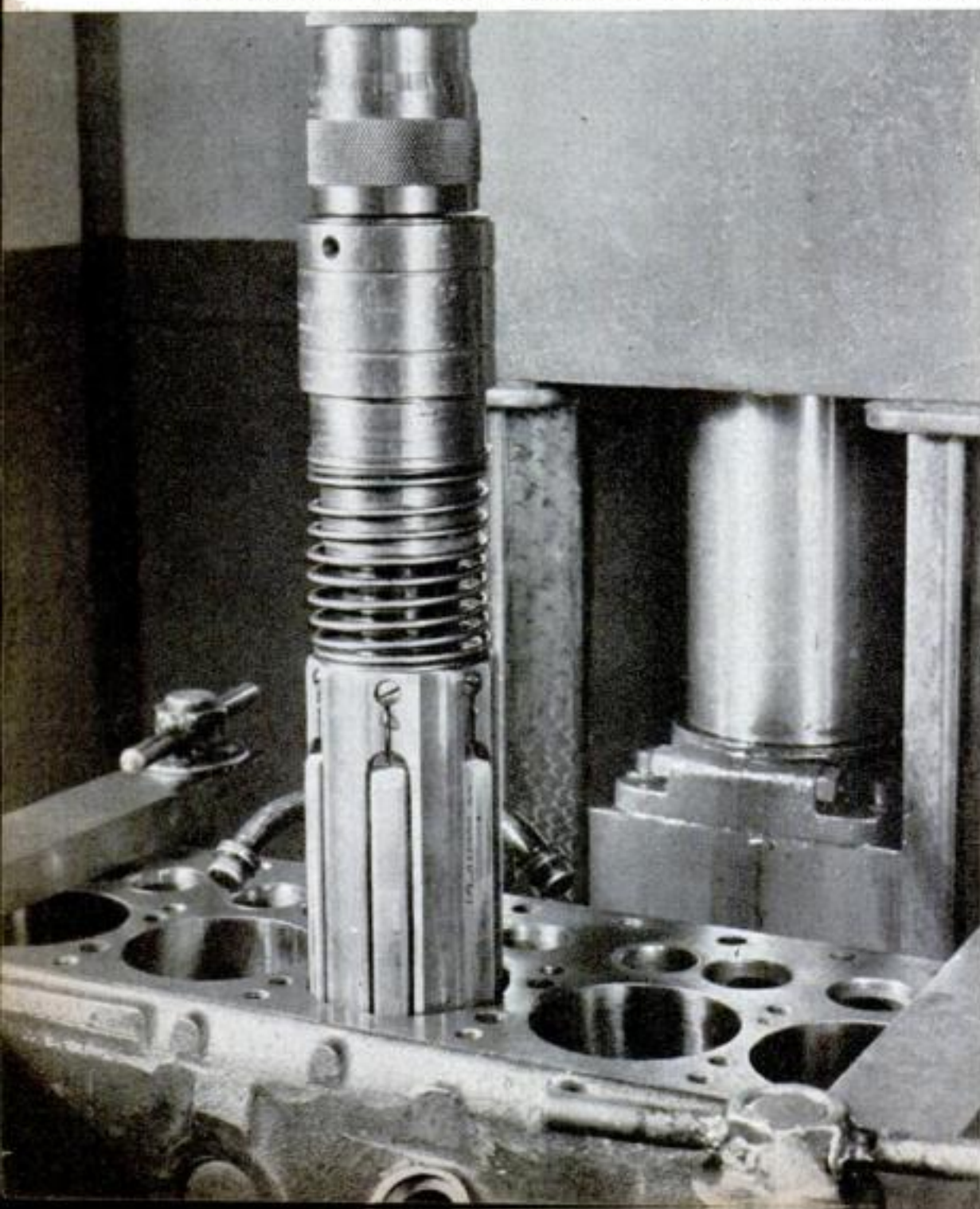
Parts of a modern automobile in which the new type of bearing surface can be employed to advantage







This machine applies Superfinish to camshafts. Unlike other applications of the process, it uses fixed abrasive wheels. The drill-like tool below puts the finish on cylinder walls



point of the metal at the point of contact. The heat softens the cementlike substance that binds the metallic crystals together, permitting them to be torn loose rather than cut flat by the action of the cutting tool or grinding wheel. The result is the troublesome fuzz. Yet if the causes of the heat—pressure and speed—are eliminated, no metal can be removed by such methods as turning and grinding.

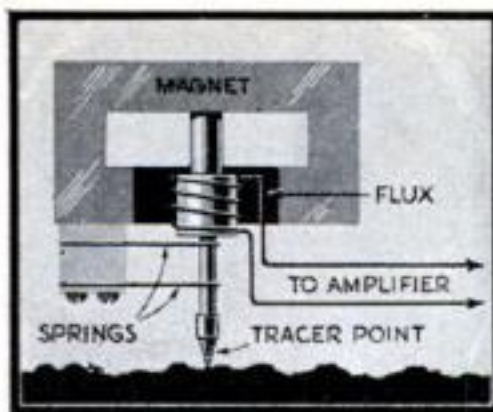
But Wallace's machine revolved slowly. It used light pressure over a wide area. And it applied it with a peculiar random motion, equally as random as the motion of a man's hand during hand lapping, while oil from a nozzle washed away abrasive dust and tiny bits of metal.

If we liken the unwanted fuzz to tall peaks and deep valleys in mountainous country, it will be easier to see what Wallace's machine accomplished. Obviously his drill-press stones began their work on the tops of the highest peaks, which they began to lop off. As they did so, tiny flat plateaus appeared where the highest points were cut off—not melted and broken. The pressure was light, so there could be no heat. The abrasives were scraping off the tops as a grader might scrape high spots from a plowed field, or as a hoe might remove snow from ice. Presently, what had been a surface of peaks and valleys was covered with wide plateaus separated by only a few of what were formerly the deepest valleys, now grown narrow. Most important of all, the plateaus were all smooth, level, and of the same height. And the remaining valleys measured but a few microinches—millionths of an inch—in depth.

Wallace recognized this as the type of surface automobile engineers hoped for when they assembled bearings to tight fits and then "broke them in" to looser fits by careful running. Cylinders and pistons, valve stems and guides, crankshafts and connecting rods, and many other "mating" bearing surfaces in cars and other machines, he reasoned, could now be made to desired clearances to start with.

But this same simple drill press had still another secret to reveal. Operated at a fixed stone pressure,





To check the smoothness of surfaces, the profilometer records irregularities in fractions of a microinch

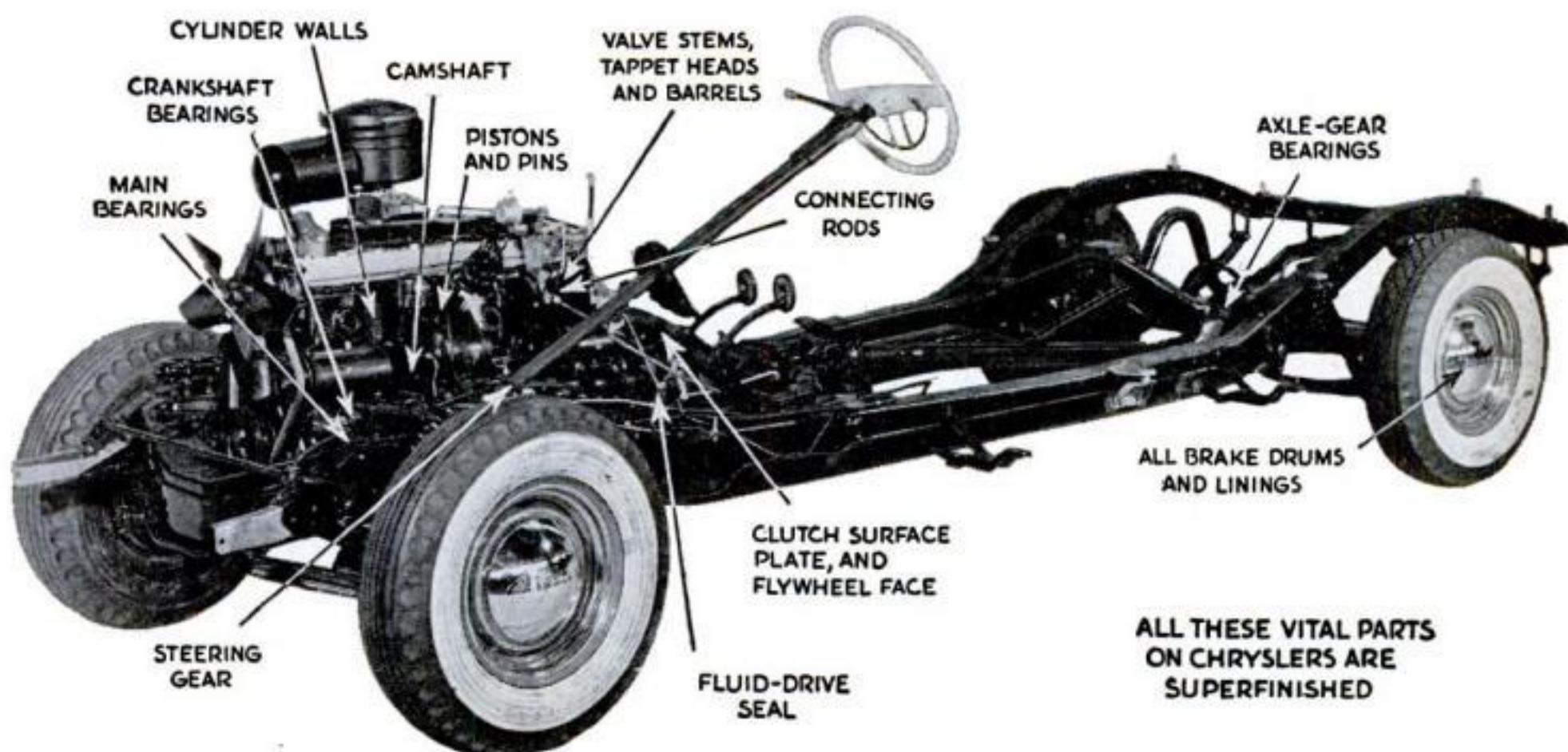


it would level off a bearing's roughness and then, almost miraculously, it would stop cutting. Careful study revealed that at first contact with the rough work, the stones ground the peaks away rapidly. But as the plateaus broadened, the stones began to glaze. After far less than a minute, the plateaus reached maximum width, and the stones became glazed to the point where they no longer possessed abrasive qualities. Even days of constant operation would remove no more metal. Yet, as soon as a new piece of work was placed under the stones, its rough surface instantly removed the glaze—dressed the stones, in shop language—and the grinding-polishing cycle started over again. Thousands of Superfinishing jobs could be handled before

it would be necessary to replace the stones.

Experiments went forward and improved machines were made. When their practicality was proved beyond doubt, Wallace decided to act. By this time, the full possibilities of Superfinishing were clear. It would benefit many industries, including his own. His business was building cars, not tool making. And there was still much development work to be done. Why not get going and do it the quickest way?

He summoned a group of machine-tool makers to Detroit and revealed all he had done. Within a short time they were attacking the problem of turning out ma-







A simple test of the smoothness of a surface is to rub it with a table-tennis ball set in a doctor's stethoscope. On a Superfinished surface, hardly any scratching can be heard

chines, essentially like his converted drill press, to do the job of Superfinishing. For they also saw that if a Superfinished rear-wheel bearing was better than any existing machined bearing, other Superfinished bearing surfaces would be better, too.

And better bearings were being sought in many fields. As proof of this, Wallace told the writer a few weeks ago that the same brinelling problem he faced five years ago was then also worrying the makers of variable-pitch airplane propellers. The propeller hubs, it was found, were brinelling under the pounding vibration of engine torque. Oddly, the wheel bearings of planes were brinelling too, he said, while carrying nothing but the weight of the wheels during flight. Makers of Diesel engines were searching for a smoother crankshaft bearing to stand up under the terrific cylinder compression—often three times that of average gasoline engines—that Diesels require. A sewing-machine maker had reached the limit of his ability to increase the speed of his machines with assurance against bearing failures.

Chrysler motors were then being "run in" for three hours on blocks. Valve tappets and the surfaces of valve stems in internal-combustion engines were an everlasting headache to engineers who strove to finish them to clearances that gave quiet operation with adequate lubrication.

Wallace hardly had to enumerate such problems to the experts he had invited to Detroit. What he wanted, he told them, was quantities of machines to do any number of Superfinishing jobs. The conference not only brought the experts' approval, but a blanket come-and-see-it invitation soon afterward touched off a modern-day pilgrimage of scientists and engineers to Detroit. Men came from shops, big and little, from executive offices of dozens of industries, from schools, colleges, and research laboratories, and from bureaus of many governments. More than 7,000 experts came, listened, and went away "sold" on Superfinish.

Among the first to act were the abrasive makers, who began studying new ways of bonding together the tiny particles of many different abrasives into solid stones. Lubricating engineers from oil companies evolved new formulas for lubricants that would work best with the best stones. In time, combinations of stones and lubricants best adapted to the Superfinishing of both metallic and non-metallic materials were worked out. And one by one, Superfinishing machines to use them were perfected by the machine-tool makers. Finally, to test and measure Superfinished surfaces, a compact, portable device called a Profilometer was designed that would quickly show on a dial the average depth of irregularities on the fine surfaces, and record them down to fractions of one microinch.

As early as 1937, David Wallace saw the first cars come off the Chrysler assembly lines with Superfinish wheel and crankshaft bearings. Today, dozens of vital parts on Chrysler-made cars are Superfinished, with a promise of durability far exceeding anything dreamed of a half dozen years ago. Airplane engines, propellers, and wheels are giving longer, better service with Superfinished parts. A sewing-machine maker is producing machines that operate safely at from two to three times their former top speed. Chrysler motors are now "run in"



for less than a half hour, and scrapping of parts that occasionally failed before has been cut almost to the vanishing point.

An outstanding feature of a Superfinished surface is the fact that it can be made to increase friction as well as to decrease it. The explanation lies partly in the factor of lubrication, partly in the surface itself. For all friction surfaces or bearings act as efficiently as they do because oil, the lubricant, actually holds them apart during operation. We have seen that a Superfinished surface consists of a great number of relatively broad, level plateaus of equal height. If all lubricant is removed from these plateaus in two "mated" surfaces, the plateaus will contact one another. And the total contacting area is proportionate to the size and smoothness of the plateaus. As this area increases—minus a lubricant—friction increases too.

In view of this, it became apparent that friction surfaces in cars, such as brakes and clutches, might well be Superfinished for better efficiency. So among the available Superfinishing machines today are those for smoothing clutch plates and brake drums, and clutch and brake linings.

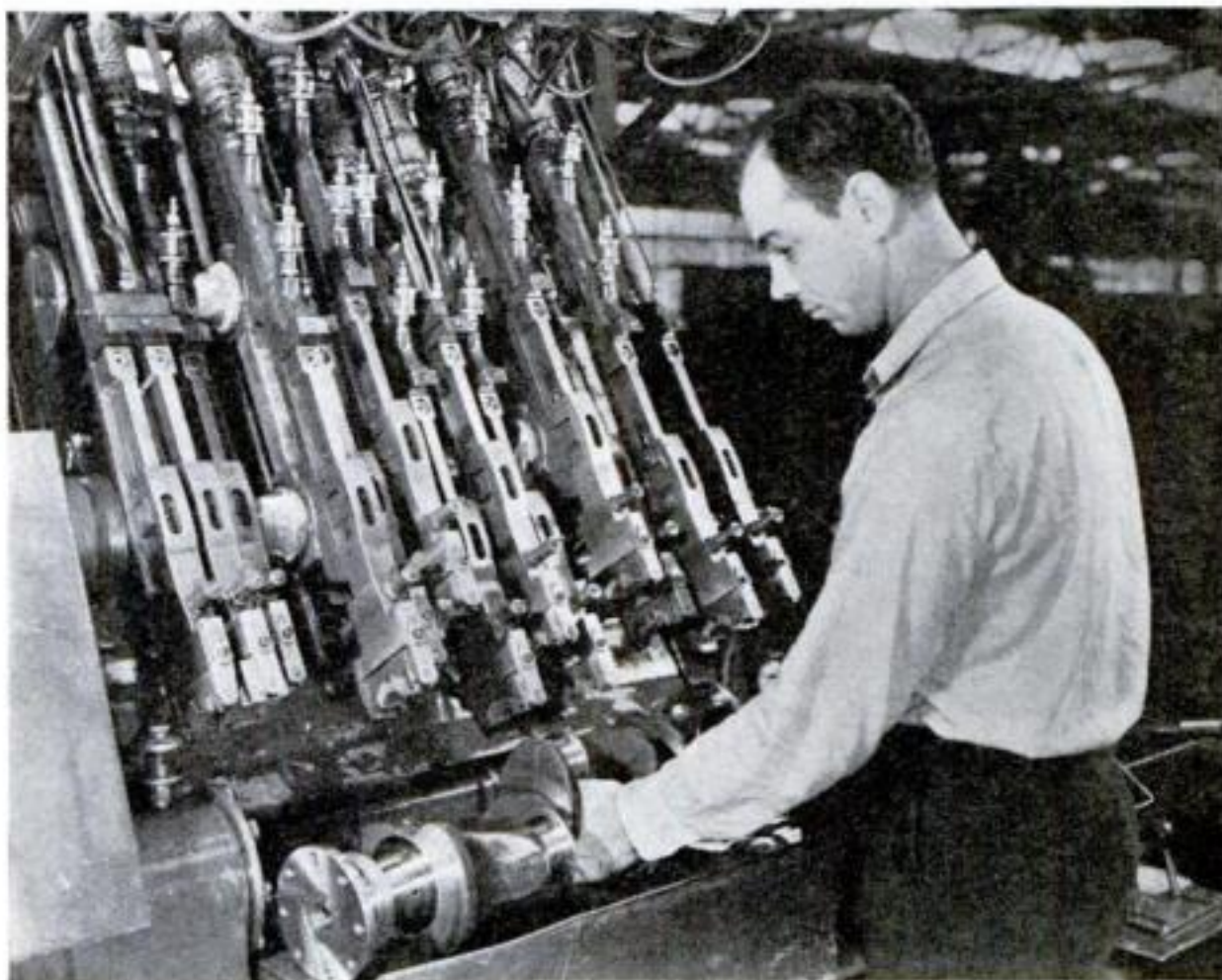
In the rolling mills of steel companies, huge rollers that squeeze out strip steel are Superfinished, to give smoother surfaces to their products. Plastic makers are getting products from Superfinished dies that don't even have to be buffed. At least four other makers of popular automobiles are solving old bearing problems with Superfinishers.

Three of the largest tractors makers have added thousands of hours of service to the

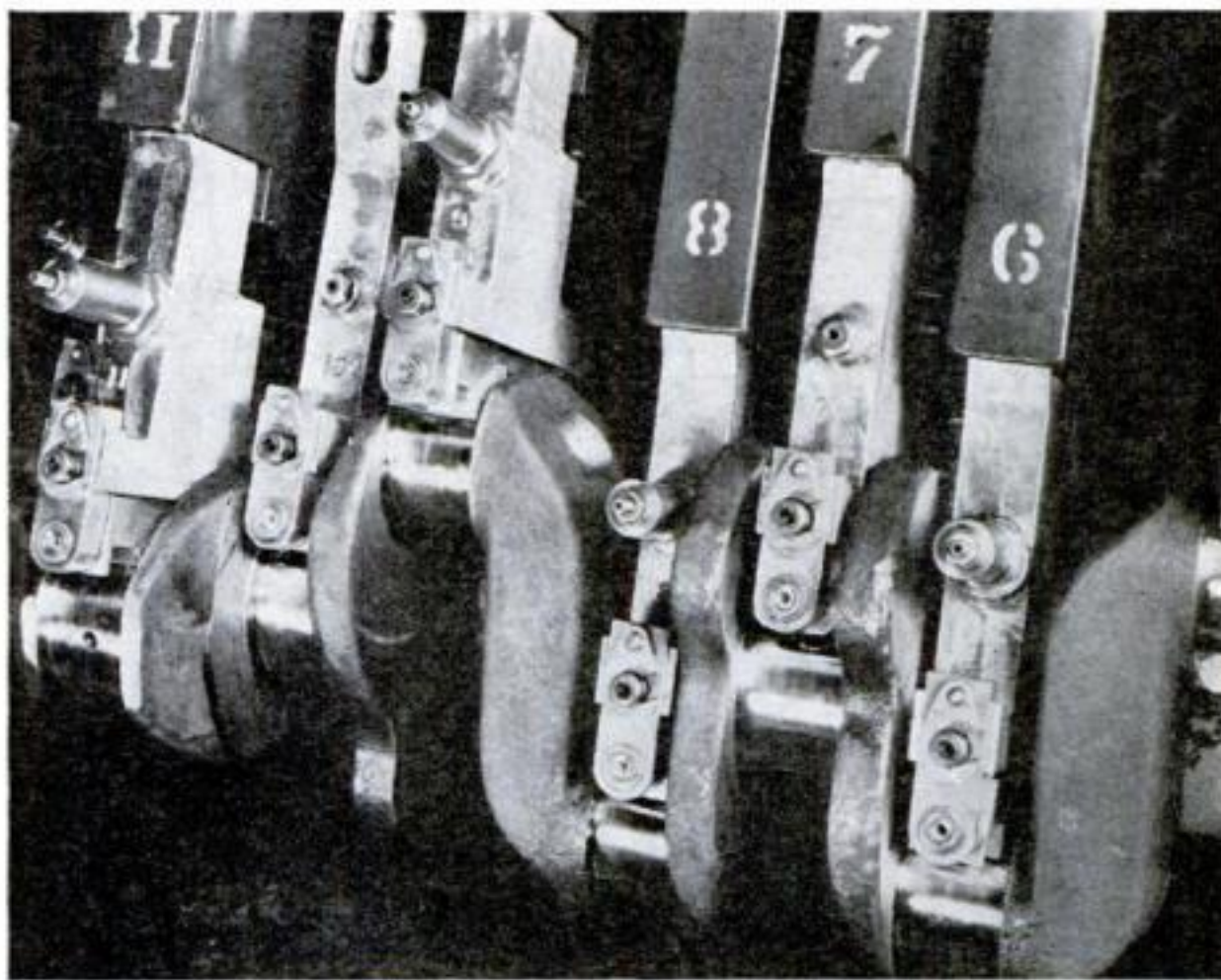
crankshafts and other heavily loaded parts of their Diesel engines—with Superfinish. The list could go on and on, and it continues to grow at exactly the rate that six of the nation's busiest machine-tool-making companies, licensed under Wallace and Chrysler patents, are able to supply Superfinishers.

"Wallace's hobby," some of his friends call Superfinish.

They say it reverently!



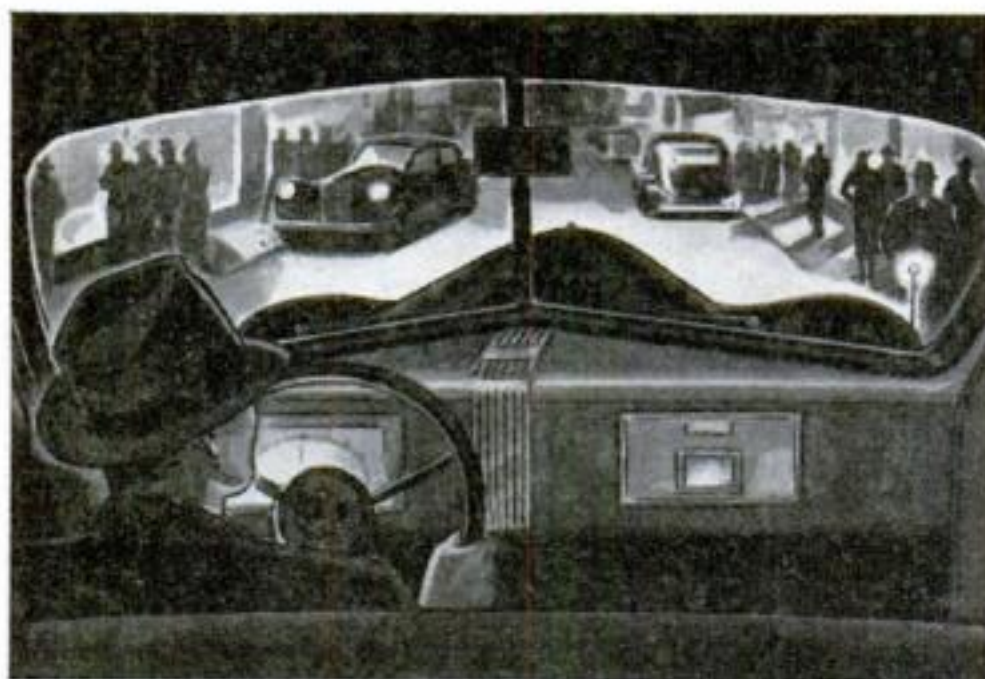
This ingenious machine puts Superfinish on crankshaft bearings. Arms carrying abrasive stones move synchronously as the crankshaft turns



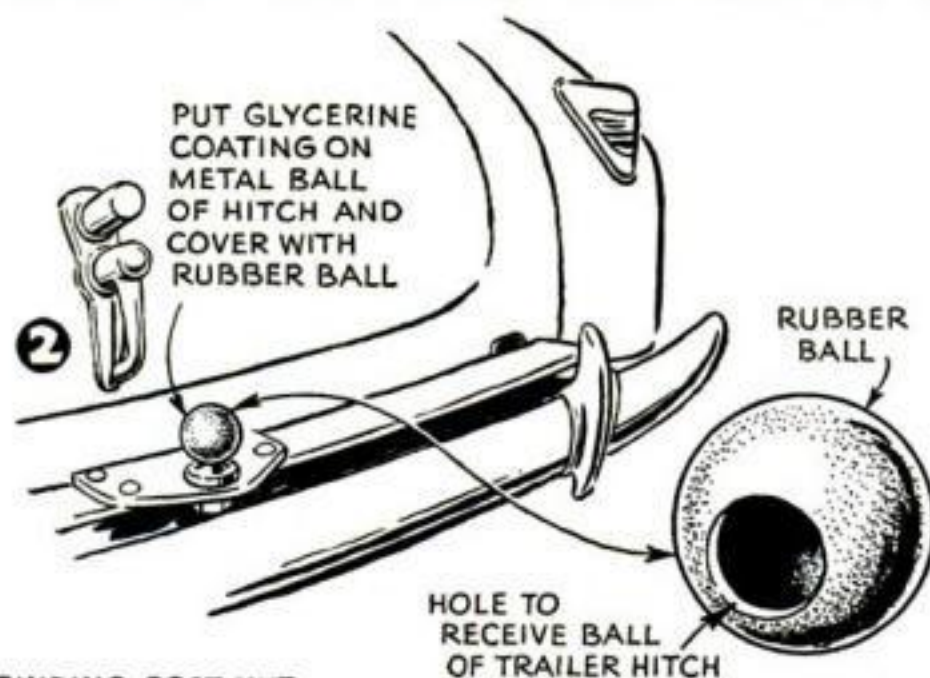
Here is a close-up of the finishing action. The abrasive stones move from side to side as the shaft revolves slowly in contact with them



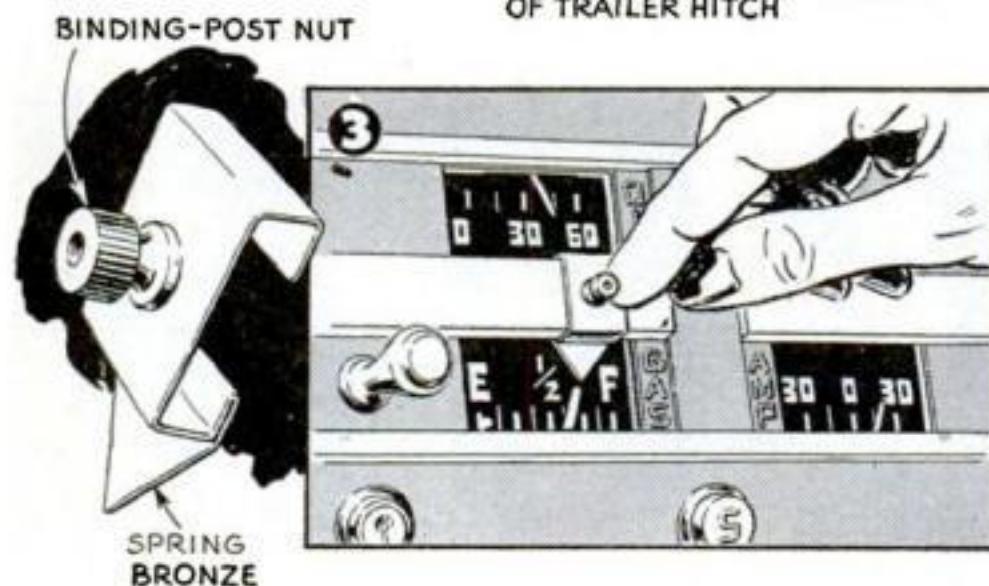
# THINGS TO DO AND



**1 A HEADLIGHT BEAM INDICATOR** mounted on a front fender where you can see it from the driver's seat, even while driving in brightly illuminated city streets, is a valuable aid to night-driving safety. Using an electric-lighted fender guide, simply connect it to the high-beam circuit of your headlights. Whenever this beam is working, the fender guide will shine and keep you constantly reminded of the fact that your headlights may be blinding a driver approaching from the opposite direction—S.J.H.



**2 WINTER PROTECTION AGAINST RUST** for the ball of a ball-and-socket trailer hitch is assured with the simple expedient of cutting a hole in a hollow rubber ball of adequate size, covering the metal ball with glycerin, and forcing the cut-away rubber ball over it. With a little care, you can get a leakproof fit in the rubber ball. Glycerin is suggested because ordinary grease or oil attacks rubber.—J.G.



**3 CHECKING GASOLINE CONSUMPTION** on a trip is made easier with a handy pointer set right over the gasoline gauge on the dashboard of a car. Made of a strip of sheet metal, the unit is cut and bent to the shape indicated in the sketch at the left. A binding-post nut from a dry cell is soldered to the unit as a handle. On some cars, the division bar over the dial face may be used to mount the unit so that it can be slid from side to side. If no such bar exists, it is easy to make one from metal and bolt it in place. To use the device, set the pointer over the needle of the gas gauge before a trip. At the end of the trip, the space separating the pointer and needle tells how much gasoline has been consumed.—W.B.



**4 WAX AND POLISH ARE APPLIED** to a car much more easily if cheap fleece-lined work gloves are turned inside out, put on the hands, and used in place of rubbing cloths for the job. A bigger rubbing surface is afforded than if folded cloth is used, and it can't slip from the hand.—E.M.

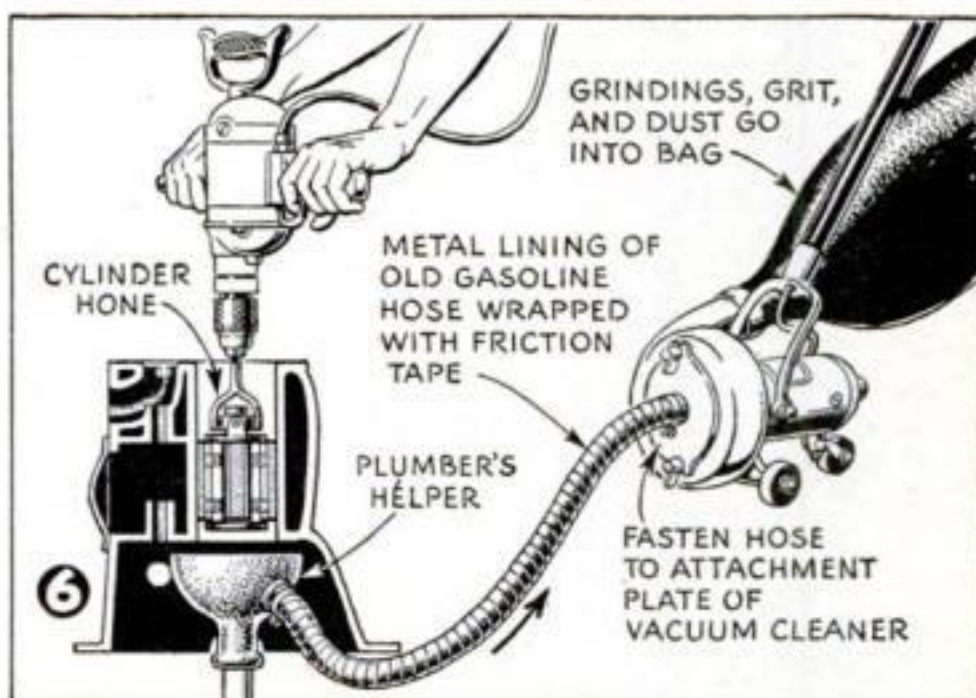


# MAKE FOR YOUR CAR

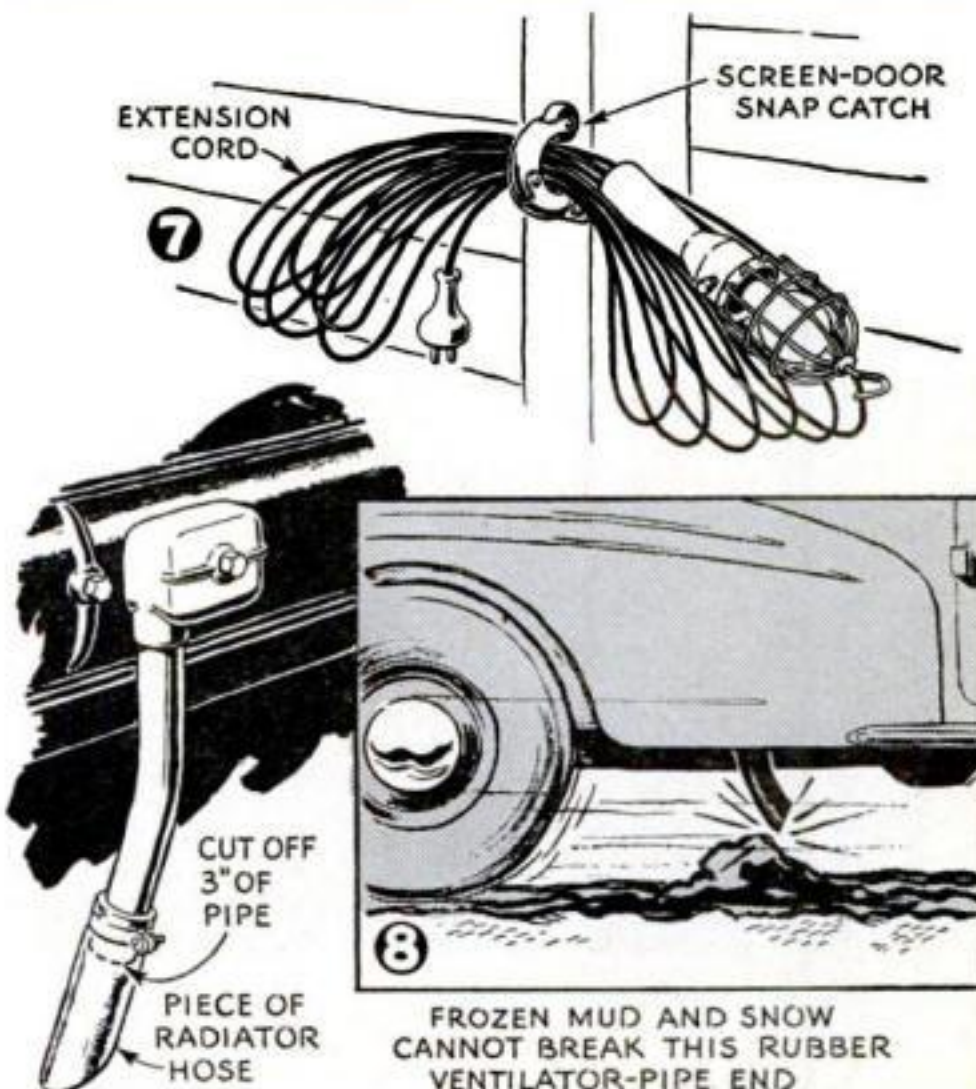
**5 AN OIL DRAIN PAN** that slides under even the low-slung new cars can be made for nothing out of a square five-gallon oil can. With a pair of sheet-metal shears, cut the can approximately as shown, leaving sides that will fit under your car's crankcase drain hole. Leave the handle attached to the top to simplify removing the pan from under the car.—W.C.A.



**6 FOR KEEPING ABRASIVE DUST** and minute particles of metal resulting from cylinder-honing operations from entering various openings in an engine block where they would be hard to clean out, I rigged up an old vacuum cleaner with a length of the metal lining of a worn-out gasoline-pump hose and a plumber's helper, as shown in the accompanying sketch. The plumber's helper is easily set below the cylinder opening of each cylinder in turn. Before starting to hone, I turn on the vacuum cleaner, which effectively sucks all the harmful particles into the dust bag. I found it a simple matter to rig up a coupling to connect the hose to the attachment plate of the cleaner. If it is preferred, the cleaner can be made to exhaust through additional hose to the open air.—C.E.C.



**7 TO HOLD AN EXTENSION CORD** on your garage wall when it is not being used, a screen-door snap catch of the type illustrated is handy. Mount it with the hinged arm pointing upward when released. Then a flip of the hand is all that is necessary to open it outward for hanging up the coiled cord. Flipped back again, the catch holds the cord securely against the stud or wall to which it is fastened.—A.H.W.



**8 ICE AND SNOW CAN'T DAMAGE** the lower end of your crankcase ventilator pipe if it is replaced with a piece of radiator hose. Cut off about three inches of the lower end of the pipe and fasten the hose on tightly with a clamp. Chunks of frozen mud or snow, extending above the road surface and striking the rubber hose, will simply bend the hose without harm.—C.L.

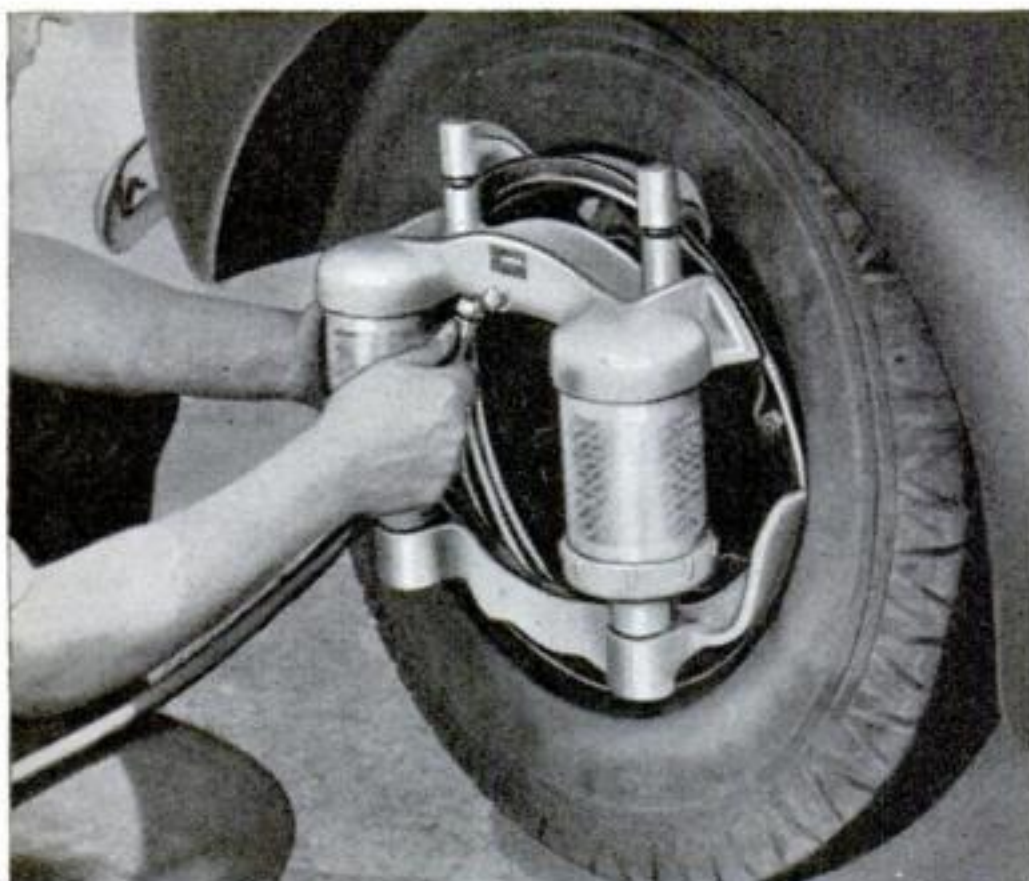




Without taking either hand from the steering wheel, the driver can tune her car radio by simply pressing a foot switch

## Switch Set in Floor Tunes Auto's Radio

TUNING your car radio is now accomplished without taking your hands from the steering wheel with a system just worked out by radio engineers. Available on several 1941 automobiles, of which one is the Nash shown at the left, the tuning control consists of a floor push-button switch operated by the toe of your shoe. The switch is connected to a magnetic control built into the radio to select the program of your choosing. Held down, the switch reduces signal volume of any station, much as a floor switch dims the headlights.



How a tire is put back on a rim with the compressed-air unit. It grabs the bead and forces it safely and quickly into place

## Air-Powered Device Puts Tire on Rim

AIR supplied by any service-station or garage air compressor now does the work of mallets, tire irons, and elbow grease in mounting tires on rims. Applied at the valve of a pneumatic machine, the compressed air enters cylinders to force pistons outward against flanges which guide the tire beads over the edges of wheel rims and drop them into place. The machine is said to work without danger of pinching inner tubes or scuffing tire casings. Moreover, it makes it unnecessary to remove a wheel from a car to change a tire, the manufacturer claims, it being but a matter of seconds to mount a tire.



Conveniently located on the steering column, the adjustable thermostat keeps air in the car at any desired temperature

## Thermostat Governs Temperature in Car

THERMOSTATIC control of the temperature inside cars is made possible, just as it is in homes, with the heater and controls shown installed in a Hudson. The equipment includes an adjustable knob mounted on the steering column which may be set at any desired point to suit the preference of the car's occupants. Once the heater is turned on, the automatic thermostat takes over the job of maintaining a uniform temperature.





Checking a Diesel's compression. Right, meter on engineer's lap tells temperatures throughout the motor

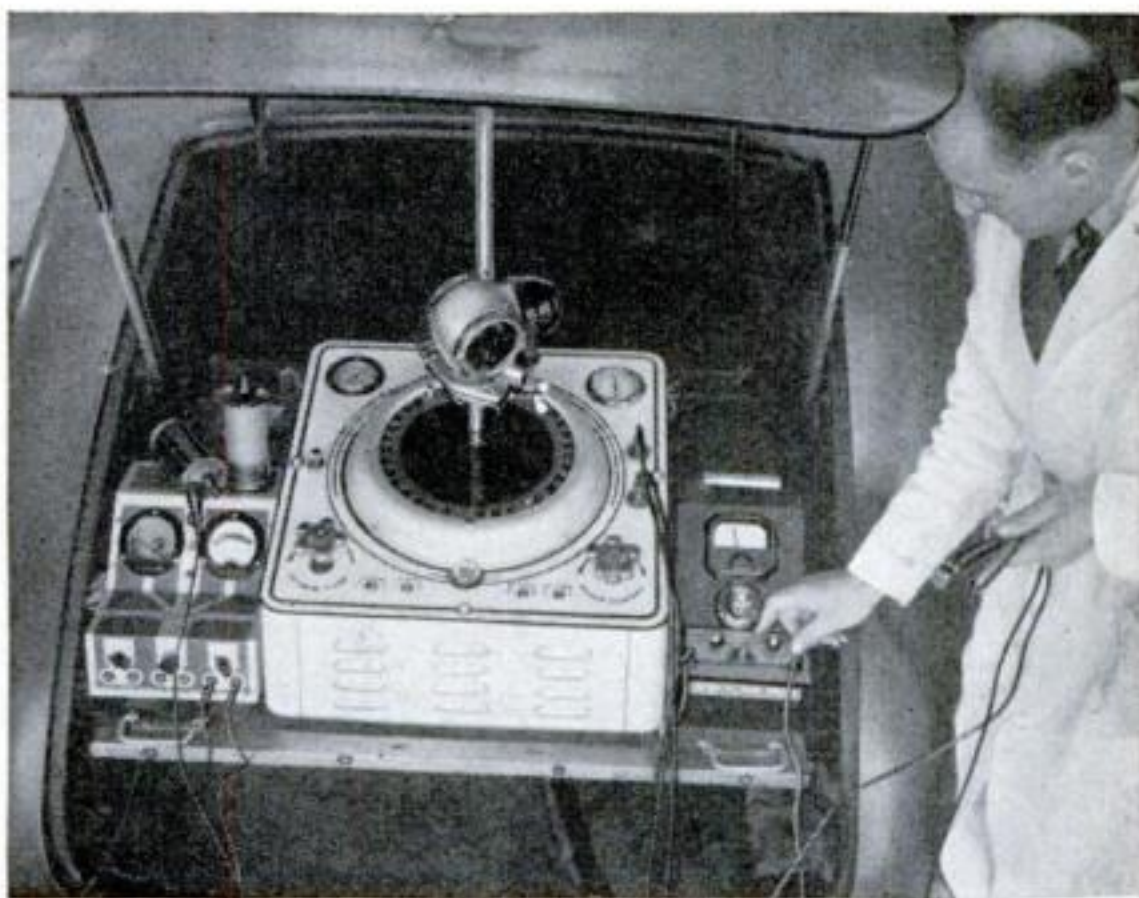
## Road Tests Check Qualities of Motor Fuels

**H**OW rapidly does a car pick up speed with a given type of gasoline? What is the compression of this or that make of Diesel engine with a certain fuel? How high are the temperatures at various points throughout a motor in service?

Using a variety of check-up devices, sales engineers of the Standard Oil Company of California invade deserts and mountains to test the performance of gasoline and Diesel-engined vehicles. With cars of various makes and models, the engineers load their trouble-shooting devices into rear trunks, packed compactly on sponge rubber to prevent damage from vibration and jolting. For some tests they fill their front seats with as many as five pieces of apparatus. Their equipment includes gauges for recording motor temperatures, performance meters to show accurately the condition of motor and brakes, vacuum gauges to record load-pulling capacities of an engine, gasoline-mileage indicators, and exhaust-gas analyzers.

In other tests, special in-

struments developed by the U.S. Navy measure the compression of each cylinder of a Diesel engine under varying conditions of load and speed. And the engineers regularly give motors a scientific going over with various fuels, much as a doctor would put a patient through exhaustive tests to discover his reactions to a special diet.



Here a trunk of a coupe is loaded with portable apparatus for analyzing the engine performance of vehicles in grueling road tests



# 12 Rules for Tire Health

**D**O YOU race your car up to traffic lights and then slam on your brakes? Do you take corners at high speeds? Gun your motor in second or low? Or bump into or over curbs? If you do, your annual tire bill is from twenty-five to fifty percent higher than it should be, according to studies made by tire engineers of the B. F. Goodrich Company, of Akron, Ohio.

And even more important, such treatment may well lower the high factor of safety built into your tires to protect life and property—your own and other people's!

Years of research and millions of dollars have gone into the design of tires that today carry your car over rough mountain roads and high-speed superhighways with equal safety and freedom from trouble. But like

the automobiles that ride on them, they will stand neglect for a limited time only. Once they become weakened or damaged by neglect or abuse, they are as dangerous as worn-out brake linings that no longer will stop your car quickly, or a cracked axle that might break when least expected.

To help drivers maintain their tires in good condition at all times, Goodrich engineers have compiled a set of simple rules which they believe will help motorists to prolong the life of their tires and reduce the number of accidents due to tire failure. The twelve rules, consisting mainly of "don'ts," are presented on the opposite page.

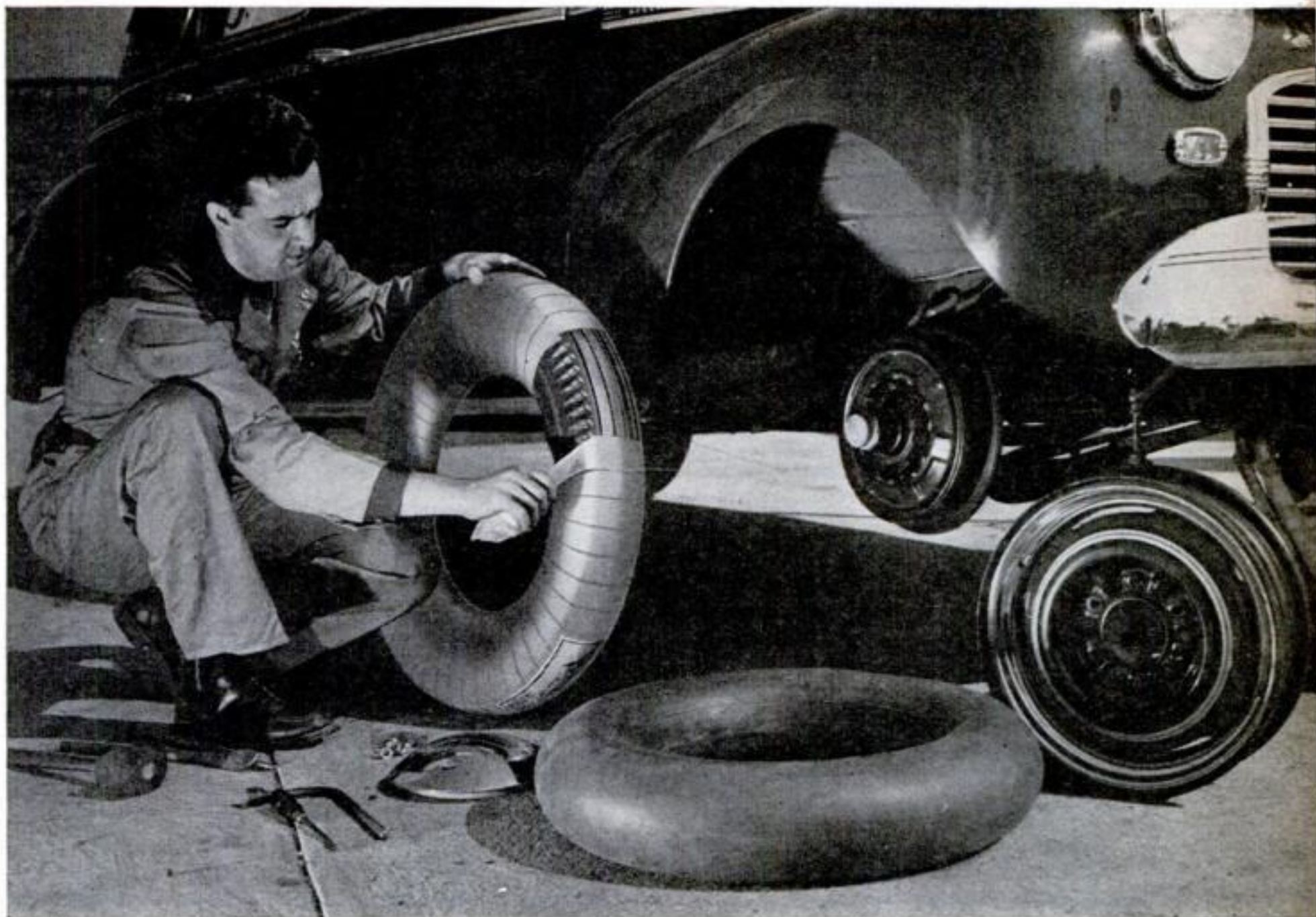
It costs plenty to neglect to keep your tires pumped up. Remember, air's free and gas-station attendants are helpful



Shift your tires occasionally from wheel to wheel for even wear, and include your spare in the program. Wheel alignment is important to tire life, and should be checked often



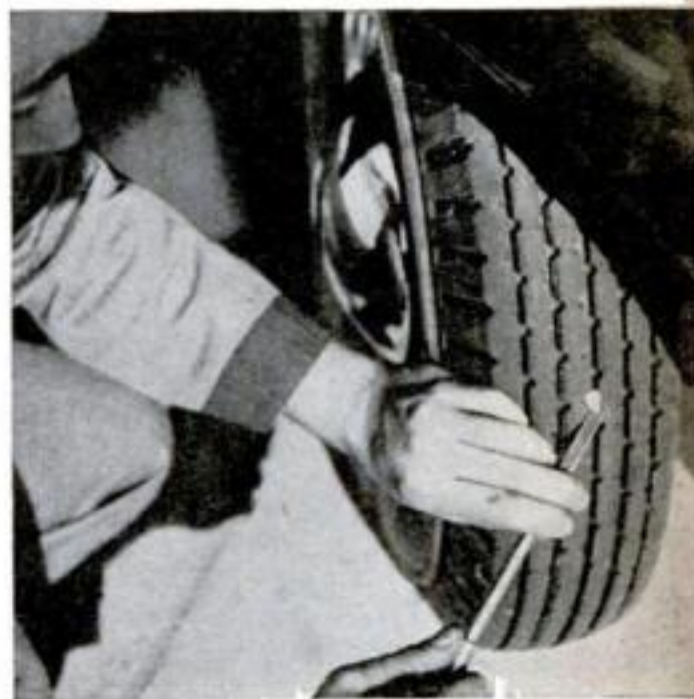




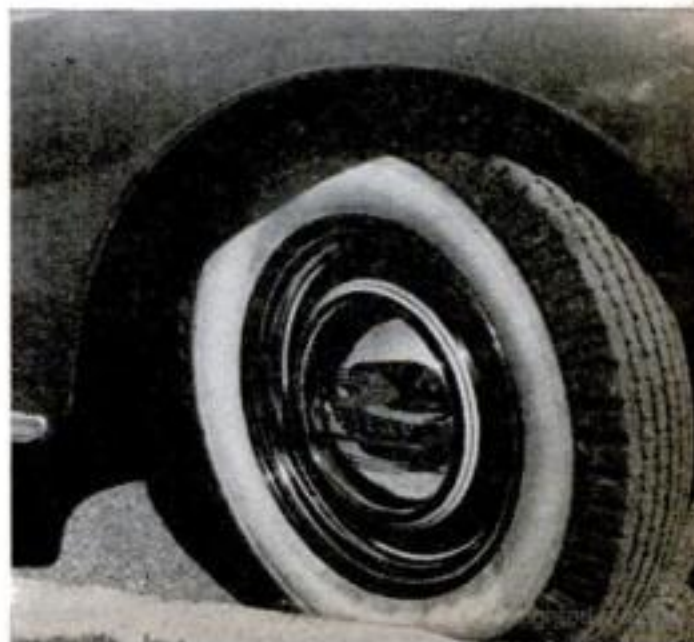
Keep tabs on a new tire, or one just repaired. It may lose several pounds in the first few minutes after it is fully inflated

## STRETCH OUT YOUR TIRE LIFE

- 1 **DON'T** let tire pressure fall below the maker's recommendations.
- 2 **A NEW** tire, or one that has just been repaired, may lose pressure soon after inflation. Check it after a few miles.
- 3 **DON'T** run a tire constantly on the same wheel. Shift your tires from wheel to wheel for even wear. Include your spare.
- 4 **DON'T** rely on the theory that it is all right to run old tires on back wheels. A rear-tire blow-out can be fatal.
- 5 **DON'T** go around corners at high speeds. It wears tires faster than anything else.
- 6 **EXCEPT** to prevent an accident, don't slam on the brakes. The most gradual braking possible is best for tires.
- 7 **HAVE** your wheel alignment checked occasionally, rear as well as front.
- 8 **LOOK** over your tires often for stones, nails, cuts, and bruises.
- 9 **DON'T** drive too fast on hot, dry roads. Extreme heat hastens deterioration.
- 10 **START** up gently. Don't spin your wheels by gunning the motor in low or second.
- 11 **DON'T** bump into curbs or run over them. Tires have not yet been perfected that can stand this kind of abuse.
- 12 **IF YOUR** car begins to steer queerly, slow down, pull off the road, and inspect all four tires carefully. The action often means a tire is preparing to blow out.



Sharp stones, nails, tacks, and other objects should be removed promptly before they cause damage. Never drive a tire against or over the curb





# GUS Tackles a Tough One

**T**HE big, well-turned-out man who had driven a speckless sedan into the shop of the Model Garage got out of it and came over to the workbench with a wide smile on his large face.

"You're Gus Wilson," he stated positively to the Model Garage proprietor. "My name's Magruder—Willis J. Magruder. Glad to meet you!"

"I'm glad to meet *you*," Gus said, wondering what he was selling. "What can I—?"

Magruder's hand gripped Gus's powerfully and he went right on talking. "I'm a nut on champions," he said. "I collect them just like some folks collect postage stamps. Name the top man in any line, and it's dollars to doughnuts I know him. Why,

say, once I drove all the way down to Kentucky and back just to have a look at Man-O'-War! I couldn't shake hands with him"—Magruder laughed heartily—"but I've shaken hands with 'most all the other champs. Joe Louis, Bill Knudsen, George M. Cohan, Jim Farley, Clark Gable, John J. Pershing, Joe DiMaggio, Doc Einstein—I know 'em all. Yes, sir, top-liners are my hobby!"

"That's an interesting hobby," Gus admitted, wondering what was coming next.

Magruder shook hands again. "I've heard all about you from my friend Doc Marvin," he went on. "He says you're a champion—the top trouble shooter of the automotive business—that you ought to be the head

"Let's take a little ride," Gus suggested. "You drive and I'll listen." Magruder climbed in behind the wheel







For withholding facts about his car, a new customer at the Model Garage — expecting miracles—will get a severe shock instead when he sees his labor bill

"There's a devil of a noise in this bus when you put the brakes on, but it wasn't where I thought it was," said Gus

man in some big organization down in the city instead of running this—this—" His voice trailed off as he tried to find a word to describe the well equipped but small shop.

Gus laughed. "The Model Garage suits me swell," he said. "I've worked for several of those big organizations you speak of, and I like this job here a whole lot better. But is there anything that I can—?"

"Yes, there is," Magruder assured him. "I didn't come in here just to waste a busy man's time. Doc Marvin says that the way you take a quick look at a car and tell just what's the matter with it is worth seeing—that it smacks of black magic. Well, just take a look at my bus, will you, and tell me what's the matter with it? It's driving me nuts!"

"Doc Marvin's put me on a spot," Gus objected. "I don't deal in magic, black or white. I've been in this game for a long time, and sometimes what I've learned in it makes it possible for me to cut corners and guess the right answer. But on most of my jobs I have to check and recheck and sweat and cuss, just as every service man does. Don't expect any miracles from me, Mr. Magruder. But I guess maybe I can find out what's the matter with your car, and fix it. How has it been acting up?"

"It's an almost new car," the big man told him. "There's less than four thousand miles on the speedometer. But every time I put the brakes on suddenly there's a loud, grinding noise that's got me worried."

"Let's take a little ride," Gus suggested. "You drive, and I'll listen."

Magruder drove out of the shop and down the highway. When he got his car up to thirty-five he pressed his foot down on the brake pedal. The brakes took hold smoothly enough, but the grinding noise was very noticeable. "Hear it?" he demanded. But there was no need to ask.

"I sure did," Gus said. "Sounded as if a chip from the gears was being

ground between the differential gear teeth. If you'll drive back slowly—don't use your brakes any more than you have to—I'll have a look."

Back in the shop, he got out a grease pump, removed the plug from the differential housing, and began drawing out the lubricant from the housing. He forced out each pumpful on a screen placed over a bucket. When he had finished, he carefully examined the screen.

"What's the mosquito netting for?" Magruder wanted to know.

"To catch any little thing like a chip off a gear tooth in the oil that shouldn't be in it," Gus told him. But when the draining was completed, there wasn't anything on the screen.

Then Gus really went to town. First he dismantled the rear-axle housing and flushed the assembly thoroughly with kerosene. Then he checked it carefully. No gears were chipped, and he couldn't find fragments from any other broken part. The faces of the gear teeth were polished brightly at the point of contact. "No smoke!" he said. "No gears are riding, and none are bottoming—and the backlash and end-play clearances seem just right."

"That doesn't mean a thing to me, not a thing," Magruder confessed. "I must have been hiding behind the door when they passed out mechanical ability. What d'you mean—that the trouble isn't what you thought it was?"

"It isn't what I thought it *might* be," Gus said. "I warned you not to expect miracles from me. This looks like one of those jobs I have to check and double-check and sweat and cuss over. The chances are it will be some time before I find out what's wrong, and then it may take me a couple of hours to fix it. You're welcome to wait if you want to, but probably it will save you a lot of time if you call up late this afternoon or tomorrow morning in-

By MARTIN BUNN



stead. By that time I should be able to tell you what the trouble is, and about how much it will cost you to have it fixed."

Magruder thought for a moment. "I guess you're right," he said. "I've got to be down in the city this afternoon and evening. I'll phone you about ten o'clock in the morning. But don't wait for my call to fix up whatever's wrong. Get started on the job as soon as you can find the trouble."

After the new customer had driven away in a taxicab, Gus fired up his pipe, perched himself on the end of the workbench, and stared at the Magruder sedan as he did a job of serious thinking. Before he had finished it, Harry, the Model Garage grease monkey—who has grown into a pretty good sort of mechanic in his own right—came in. He watched his thoughtfully silent boss for a few minutes, and then he asked: "Stuck?"

Gus grinned at him. "Stuck tight," he admitted. "There's the devil of a noise in this bus whenever you put the brakes on hard. Sounded to me as if it was in the differential, but it wasn't where I thought it was. So what?"

"Brakes, maybe?" Harry suggested. "Rear-wheel bearings?"

"Give me a hand," Gus said, "and we'll find out."

They took off the rear wheels, and Gus examined them carefully. The wheels weren't bent, the tires gave no indication of uneven wear, the bearings seated properly on the axle, and the axle keys were tight.

Gus grunted, and started checking the brakes. The contact surfaces of both the drums and the brake linings were as good as they had been the day the car had come off the assembly line. The brake shoes also were good as new, and the anchors were tight.

Harry wiped sweat off his forehead with the back of a greasy hand. "Nothing there," he said.

"It's *somewhere*, that's sure!" Gus growled. "I'll take another look at that differential."

They uncoupled the drive shaft and this time took the differential assembly completely out of the car. Gus examined it, and gave special attention to the universal-joint needle bearings, but they showed no wear, and were well lubricated. "By gum," he said. "I'll find the cause of that grind if we have to tear down the whole differential gear assembly."

They tore it down, but they didn't find the cause of the noise. Then Gus reassembled it in a vise on his workbench, and found that it ran smoothly both forward and backward. They cleaned the rear-axle housing, reassembled it, and filled it with lubricant. It ran sweetly when they put it on jacks.

Gus tipped the peak of his cap over his left eye and scratched his right ear—a sure sign that he was buffaloed.

"Maybe we fixed whatever was wrong without knowing it—I've had that happen to me more than once or twice."

When the car was removed from the lift, he took it out for a road test. Within ten minutes he was back.

"How was it?" Harry demanded.

"Just the same as it was before I fixed it," Gus grumbled. "Maybe it's in the trans-

mission. Or maybe in the clutch. We'll have to—"

"Wait a minute!" Harry interrupted. "Don't you ever look at the clock?"

Gus looked at the shop clock. It was after six. "I'm sorry," he said. "You go ahead home."

"What are you going to do?" Harry wanted to know.

"I'm going down to the Park House and get my dinner," Gus told him. "Then I'm coming back here and lick that job if it takes me half the night. If I don't, I won't be able to sleep for thinking about it."

"I'll stick with you," Harry offered. "I wouldn't walk out on the old master while he's in the middle of a dither!"

"I'll dither you!" Gus said. "Come on—get washed up and we'll eat."

"Well, now, we've got to hunt," Gus observed when they got back from dinner. "The brakes, wheels, and differential are all right, so the noise can't be coming from the rear end, even if it sounds as if it is. Let's have a look at the transmission."

They dropped the drive shaft and removed the transmission, disassembled it, and examined it carefully. Not a gear tooth was broken or even so much as worn. Neither were any of the bearings. No loose nut was fouling the gears.

"Transmission's O.K.," Gus decided. "This is getting interesting. We'll have to check the clutch. Sometimes a projecting rivet, or a poorly fitting thrust ring makes a grinding noise. (Continued on page 224)

## GUS SAYS:

I recently read where one of the engineers from a big auto company declared that thirteen percent of your engine power is lost if your tires are six pounds underinflated. At ten pounds under, almost one quarter is wasted. That's something for drivers to think about!



# HOME and WORKSHOP

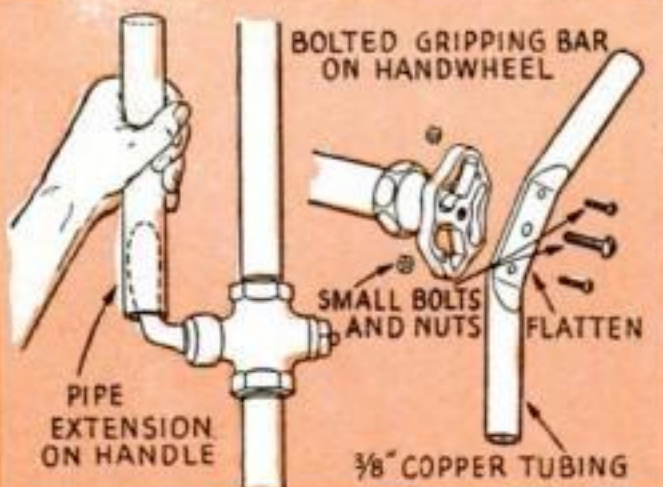
MASTERING HOME PLUMBING REPAIRS  
JOGGLING BOARD BUILDING SECRETS  
HOW TO USE YOUR CAMERA ON A WALK



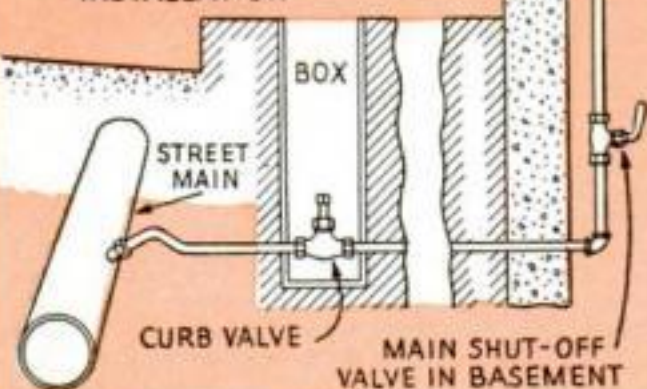


# HOME PLUMBING REPAIRS

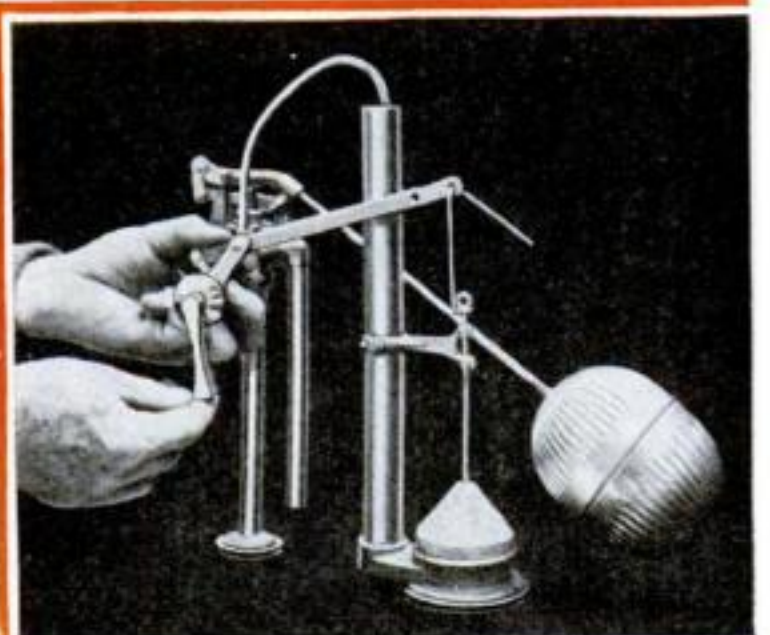
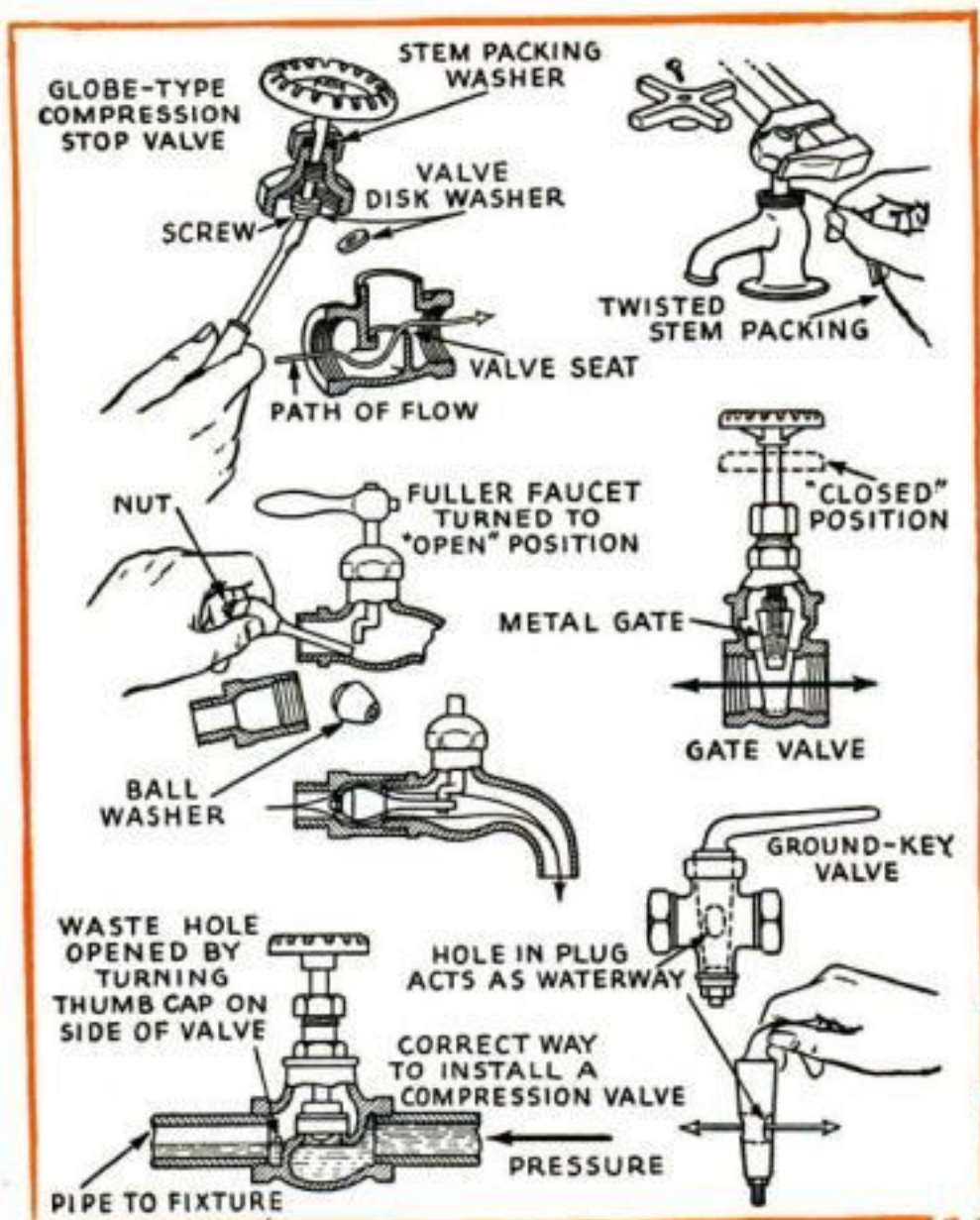
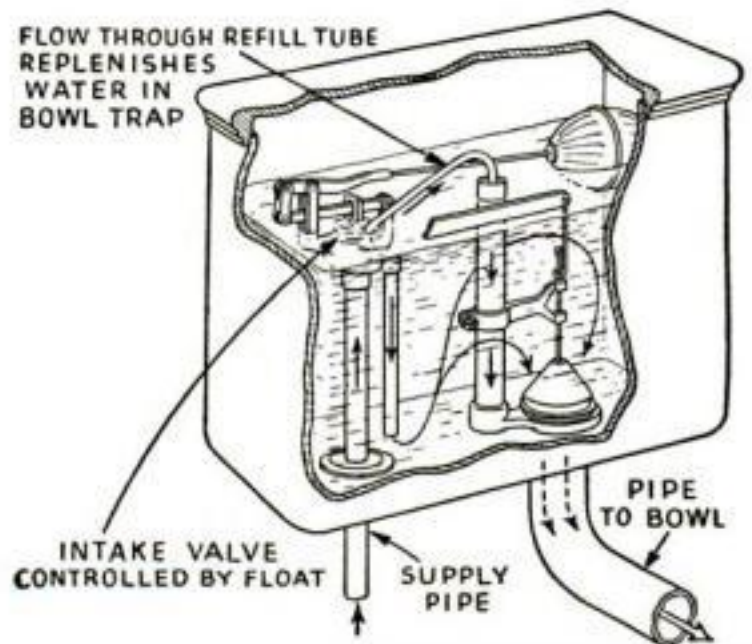
By JOHN MODROCH



TYPICAL WATER SERVICE INSTALLATION



**A** LITTLE knowledge wisely applied in the care and repair of the plumbing system will save the home owner many dollars. To prevent damage in the event of a serious water leak, it is advisable that the entire household be familiar with the location of every shut-off valve. A coat of white paint applied to the valves will make them easy to recognize. Black letters indentifying each one according to the fixture it controls may also be added, although paper tags will serve the same purpose. It is also a good idea to label the main shut-off valve still more prominently, as by painting



If the average flush tank were of glass, this is how the valve mechanism would look



a short section of the piping leading to and from it.

Difficulty in closing a valve in an emergency can be prevented by putting an extension arm on the handle or by bolting a gripping bar across the handwheel. If there is no main shut-off valve in the house, the location of the curb, or street, valve should be known and the valve box kept accessible.

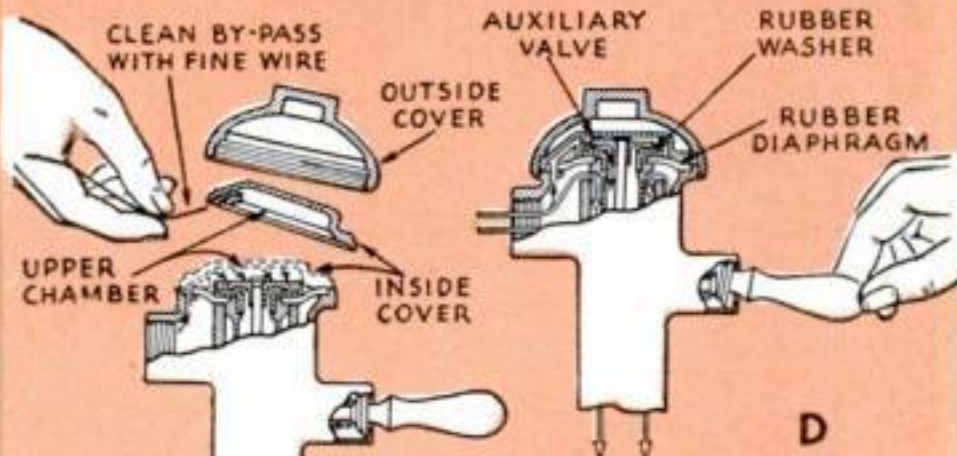
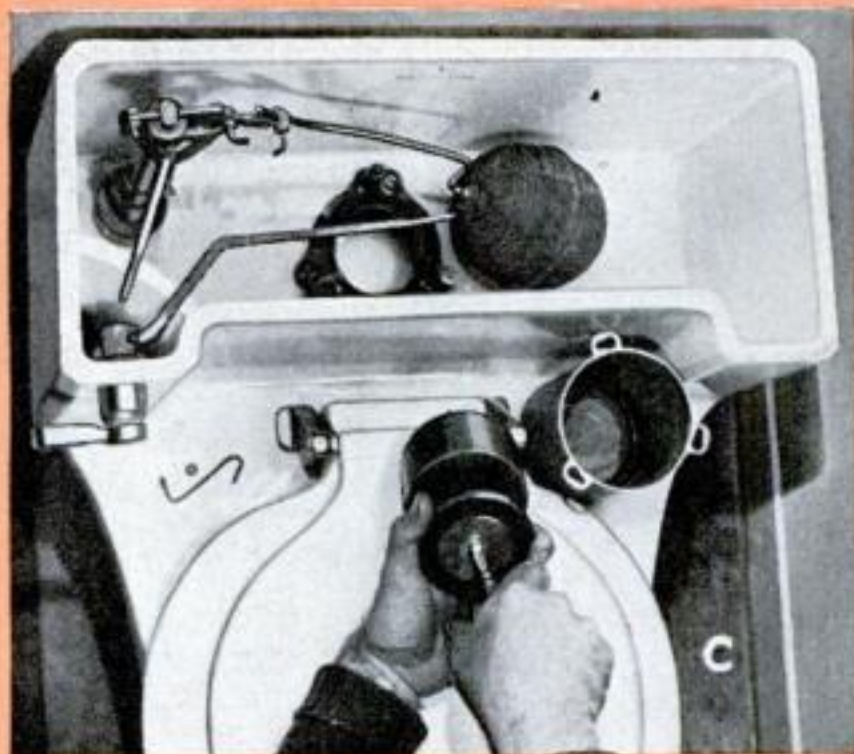
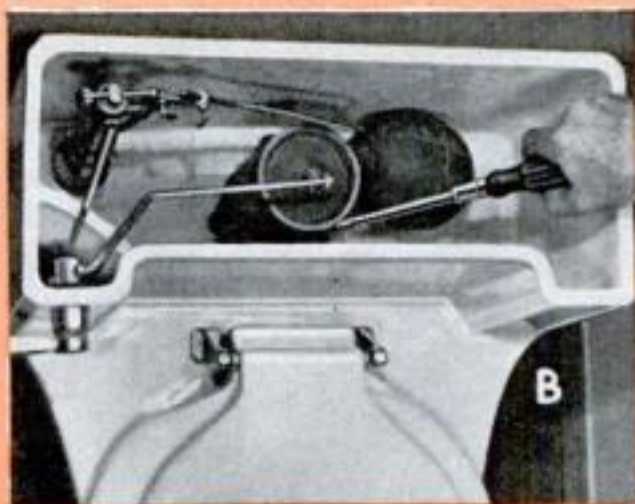
If, when closed, a valve fails to stop the flow of water, the trouble can usually be remedied by replacing its washer. There are two commonly used types of valves and faucets that have replaceable washers, as noted in the drawings. Fiber washers will stand up under use in both cold- and hot-water lines. Soft rubber washers should be used only in cold-water valves. Be sure, after replacing the washer, to turn the binding screw down tight; a loose washer tends to vibrate noisily.

The other types of valves shown

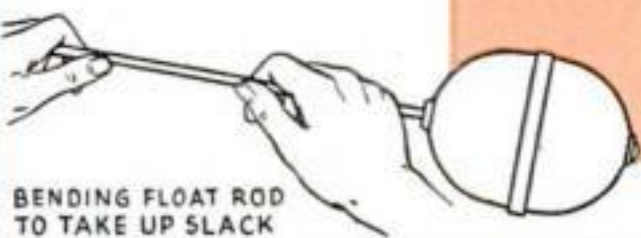
A one-piece toilet like that shown at A has a large rubber disk washer. To replace it, take off the valve shell by loosening the retaining screws as shown at B; then unscrew the metal disk that clamps the washer in the cup as at C. The type of valve shown at D operates as follows: The handle tilts an auxiliary valve, releasing pressure in the upper chamber. Pipe-line pressure lifts the diaphragm, allowing water to flow through valve. Meanwhile, water flowing through a by-pass fills upper chamber and closes valve



ONE-PIECE TOILET



D



BENDING FLOAT ROD TO TAKE UP SLACK



To replace the intake-valve washer, the valve plunger must be removed

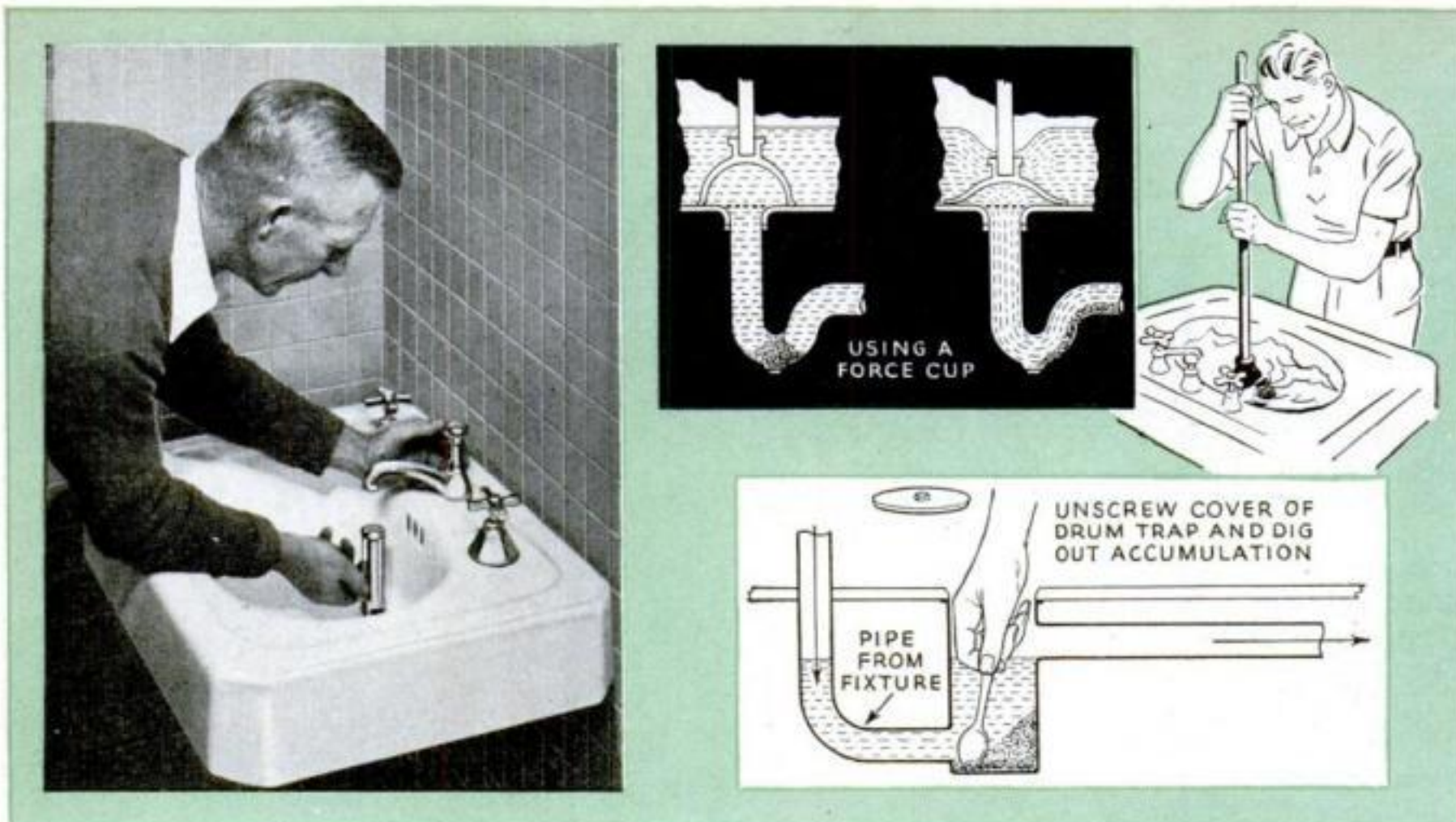


Substituting a new, springy rubber valve ball at outlet



Allow ample play at the point marked by the arrow





Pop-up lavatory stopper tubes should frequently be lifted out and cleaned. Obstructions in ordinary traps can usually be removed with a force cup. Where drum traps are used, dig out the accumulation

have no washers, but the metal-to-metal contact of accurately machined parts seals the waterway. When these valves fail, replace them with new ones.

If a valve leaks around the stem, a slight turn on the packing nut may stop it. If not, remove the nut and replace the rubber washer or wicking with fresh packing. Ordinary cotton string rubbed with soap and twisted double can be wound tightly around the stem to serve as packing for cold-water valves. For hot-water valves, an asbestos or a graphite packing should be used.

The automatic controls most likely to get out of order as a result of wear and neglect are those located in the flush tank of the toilet. The result is either an erratic flushing action or a constant running of water down the overflow tube. To remedy this, bend the float rod to make allowance for the slack.

When the parts become corroded to the point where proper adjustment of the action is impossible, they should be replaced with new ones. If the metal ball float has shipped water as a result of a leak, it also will foul the valve action. This trouble can be corrected by soldering up the hole or by installing a new float ball.

Providing its metal parts are in good condition, a leaking intake valve in the flush can be fixed merely by replacing its washer or washers, as the case may be. To do so, first shut off the water supply, then disconnect the float mechanism and lift out the valve plunger. Take out the rubber valve

washer by unscrewing the retaining ring from the end of the plunger. Remove the leather stuffing washer, if there is one, by lifting it out with your finger nail.

If the washers prove to be in good shape, the leak may have been caused by chips of pipe scale lodged between the plunger and the valve seat. In this case, thoroughly clean out the valve housing before replacing the plunger.

The outlet valve at the bottom of the tank is another common source of trouble. In one type of tank, this consists of a rubber ball that is pressed down against the rim of the valve by the weight of the water when the tank is full, thus sealing the opening. With age, this ball hardens or swells out of shape and must be replaced. One good grade of mushroom-type replacement ball is sold in a sealed can to preserve its liveliness. It will prove convenient, therefore, to keep an extra one on hand. In order to seat properly, a rubber flush ball must hang in perfect alignment with the rim of the valve. Adjustment of the guide arm, if required, can be made after loosening the two screws that clamp it on the overflow tube.

If the overflow tube springs a leak around the threads at its base, unscrew it from the outlet valve housing and install a new one. A leak at this point will be indicated by the constant running of water into the bowl.

A large rubber disk washer, instead of a rubber ball, is used to close the outlet valve of the one-piece toilet illustrated. When worn, this washer can readily be removed for replacement by first taking off the shell



that covers the float. Then remove the metal disk that clamps the washer in the cup by turning out the binding screw.

Toilet flush valves, commonly used instead of flush tanks in apartments and other large buildings, will let water run continuously if the by-pass is stopped up or if an accumulation of sediment prevents the auxiliary valve from seating. In a valve of this type, the by-pass and auxiliary valve seat can usually be reached for cleaning by unscrewing the outside cover. A spanner wrench, or similar tool, however, may be needed for unscrewing the retaining disk that holds down the rubber auxiliary washer and main diaphragm, both of which are replaceable.

If waste water drains slowly from a fixture and gurgles while going down, it is a sign the drain is clogged. A rubber force cup, such as the one shown, will usually open up a sink or closet drain that is only slightly clogged. An obstinate stoppage, though, will require the use of a length of spring cable or a coil-spring auger.

Solids and hardened grease deposited in a U- or S-shaped trap can be removed by unscrewing the plug at the bottom. Sediment must be dug out of a drum-type trap after screwing off the cover. The removable stopper tube of a lavatory equipped with a pop-up waste frequently gets clogged, so it should be lifted out and cleaned regularly.

When using a toilet-bowl coil-spring auger for removing stoppages in the trap, the technique employed should suit the nature of the obstruction. Rags, for example, must be worked out slowly, while hard ob-

jects call for a quick back-and-forth action of the snake to jump them back through the passages.

Prepared chemicals sold expressly for cleaning toilet traps are labeled with explicit instructions for their use. These should be followed carefully to avoid possible damage to the plumbing. Certain chemicals should not be used at all in drains. Caustic soda, for example, forms an almost insoluble hard soap upon coming in contact with grease.

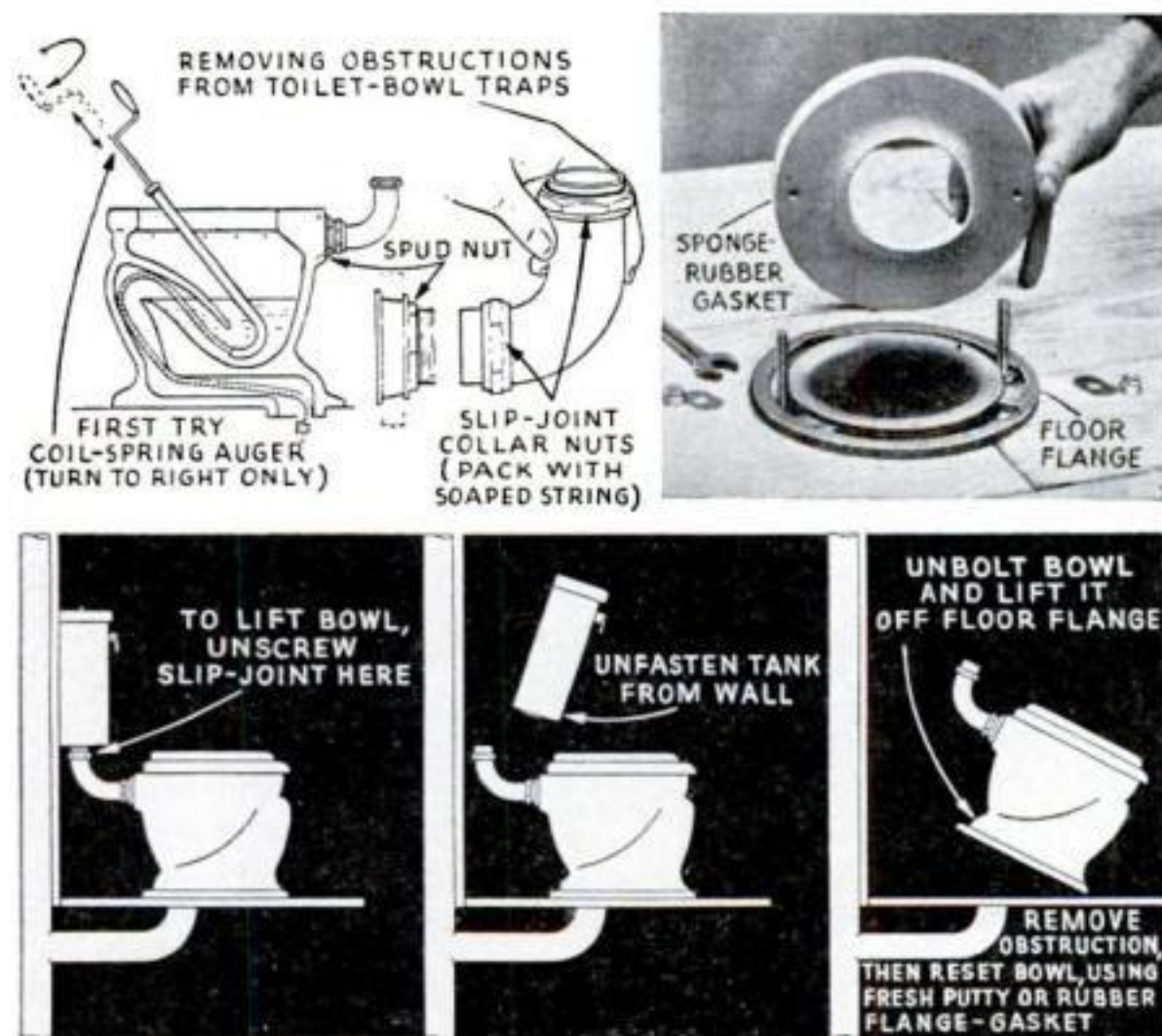
Unnecessary damage to the connections is often caused by home owners who try to take up the toilet bowl without first disconnecting the flush tank. If the flush tank is removed first, the spud collar-nut on the outside of the bowl need not be touched at all. It is usually necessary only to unscrew the slip joint at the tank end of the elbow, leaving the other end connected to the bowl. The tank can then be unscrewed and lifted off the wall, allowing the bowl to be unbolted and lifted off the drain connection on the floor.

Before removing the fixtures, it is necessary, of course, to shut off the water supply, drain the tank, disconnect the supply pipe, and also bail out the water remaining in the bowl trap. With the bowl laid on its side, access to the clogged passage of the trap can be gained easily through the bottom.

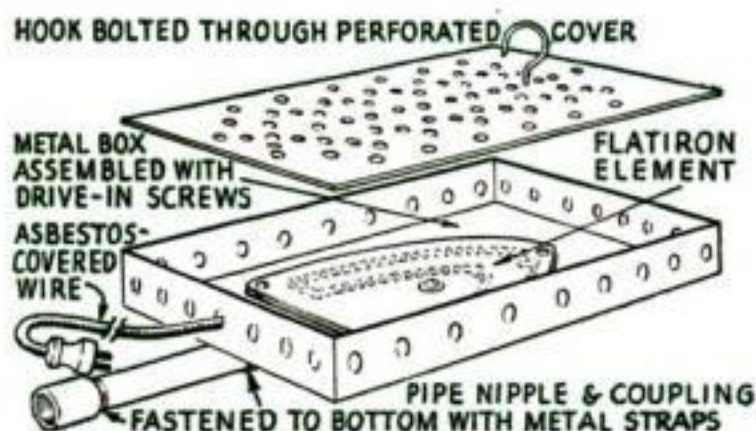
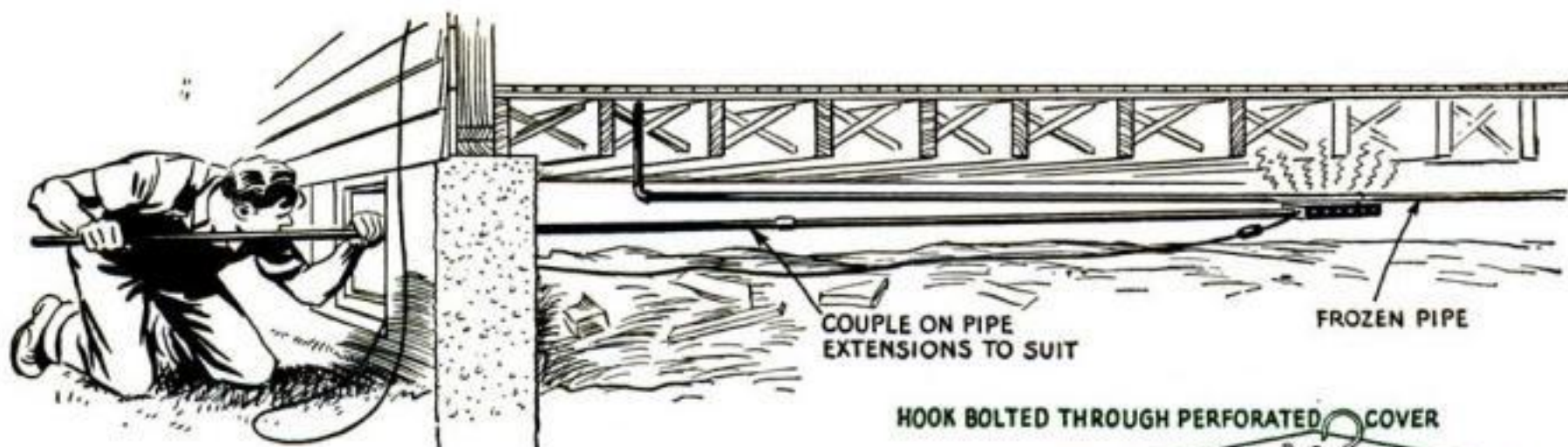
A new sponge-rubber floor-flange gasket or several pounds of putty should be on hand for use as joint packing when resetting the toilet bowl. If putty is used, turn the bowl upside down and lay a mound of it around the outlet opening. Then turn the bowl right side up and reset it.

Should a stoppage of a drain occur at a point beyond the trap of the fixture, run a length of springy cable, such as a piano wire, down through the soil pipe. For this purpose, plumbers carry a special soil-pipe auger. Access to the soil pipe running out under the house can be had by removing the plug of the clean-out tee usually located in the basement.

A common practice for preventing unprotected pipes from freezing up solidly is to let the faucets run in a fine but continuous stream of water. A pressure relief valve inserted in an exposed line will also afford the piping some protection by relieving the pressure







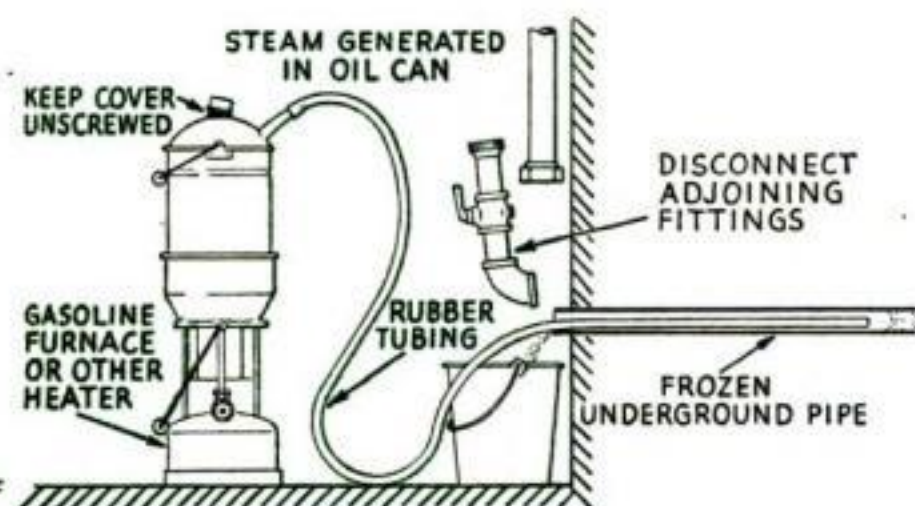
exerted by the formation of solid ice.

When plumbing is not in use, the surest way of preventing it from freezing is to shut off the water and drain the system. To do this, open the drain fitting located at the lowest point in the system and also all faucets so as to relieve the vacuum in the lines. Water must be drained from the toilet, flush tank, the water-heating system, and all traps, including the toilet bowl. Traps may then be filled with a non-freezing liquid, such as kerosene or radiator antifreeze, to maintain the seal against sewer gases.

A frozen water pipe should be thawed systematically by beginning at the faucet, or outlet end, and working back toward the main supply line. Open the faucet to permit the water from the melting ice to drain out, and turn on the main valve to allow the line pressure to help break up the ice.

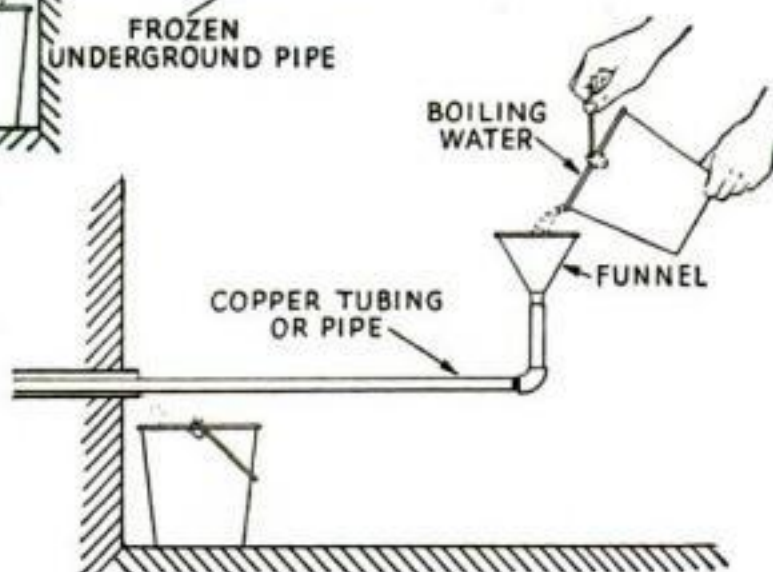
Where there is no danger of burning nearby woodwork, exposed piping can be thawed quickly by applying the flame of a blowtorch. Take care, however, to spread the heat evenly by playing the flame back and forth constantly along the pipe. Where danger of fire exists, hot bricks, electric heaters, and boiling water poured over a wrapping of cloths can be used.

The homemade electric thawing de-



Hard-to-reach water pipes can be thawed with steam fed through a rubber tube

Another method is to set up copper tubing or small pipe so that boiling water can be poured into the frozen pipe





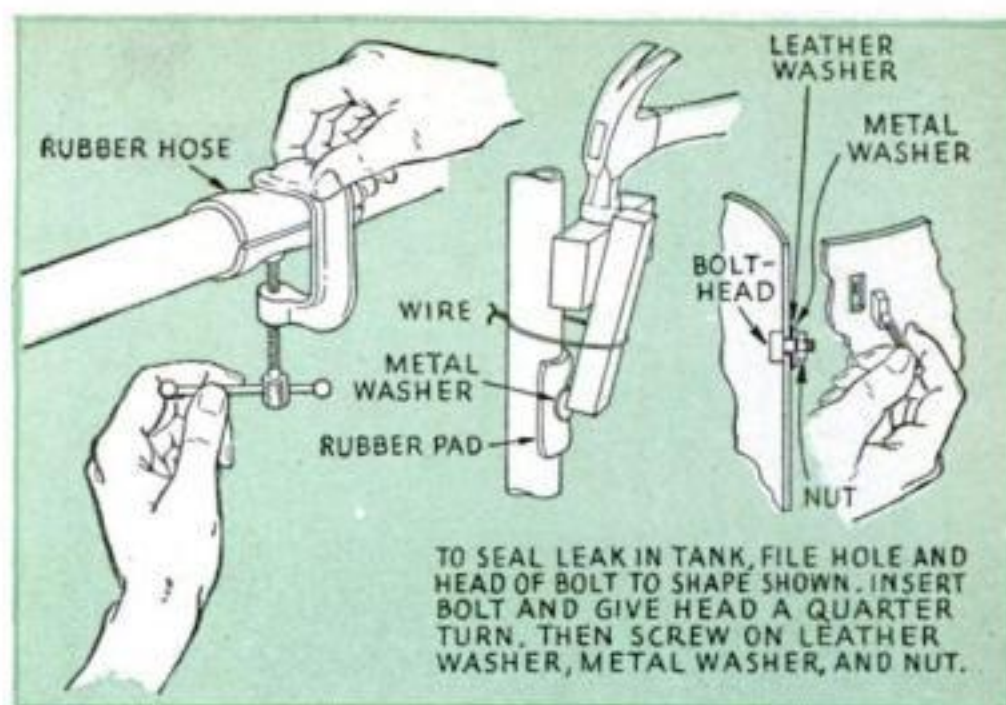
vice illustrated, costing less than fifty cents to build, permits frozen pipes under buildings and in other hard-to-reach places to be thawed with safety. It consists of a flat-iron element housed in a protective perforated metal box.

When thawing pipes concealed under floors, in partitions, and under the ground, the work must be carried on from one end, as illustrated. Steam generated by boiling water in an oil can, to which a suitable length of rubber hose is attached, can be used effectively for doing the job. The tubing should be fed into the pipe as fast as the ice melts, so as to keep the steam in contact with the unmelted portion. To avoid any possible danger that the can will blow up from excess steam pressure, *be sure to keep the cover unscrewed and merely laid over the cover hole.*

Boiling water may be used in a similar manner. It should be poured into a funnel attached to the end of the tubing. When thawing a long run of pipe, however, it will be found more practical to substitute copper tubing or small size pipe for the rubber tubing.

When time is an important factor, the electric pipe-thawing method—a service often offered by electric welding companies—is probably the most expedient one to use on long underground water lines.

If the formation of ice in a frozen pipe has caused a break, emergency pipe-leak repairs can be made by the home owner with whatever common materials he has on



Two ways to stop a pipe leak and method of repairing tanks

hand. Iron cement and friction tape, a short piece of hose and a C-clamp, a pad of rubber and an improvised wedge are some typical examples. The trick of using a leather washer and a stove bolt for making a temporary repair of a leak in a storage tank is also shown.

If an extremely slow leak at a pipe joint is caused by continual vibration or movement of the pipes, it can usually be stopped by making the joint rigid with cleats and straps. Stopping the movement at the joint gives the dope on the threads a chance to coagulate, thus sealing the leak.

Cold-water pipes in basements and in rooms lacking good air circulation are likely to "sweat" on humid days in the summer time. Providing adequate ventilation or incasing the pipes in a sealed air-cell covering are the alternate remedies.

## PROTECTIVE HAND CREAM

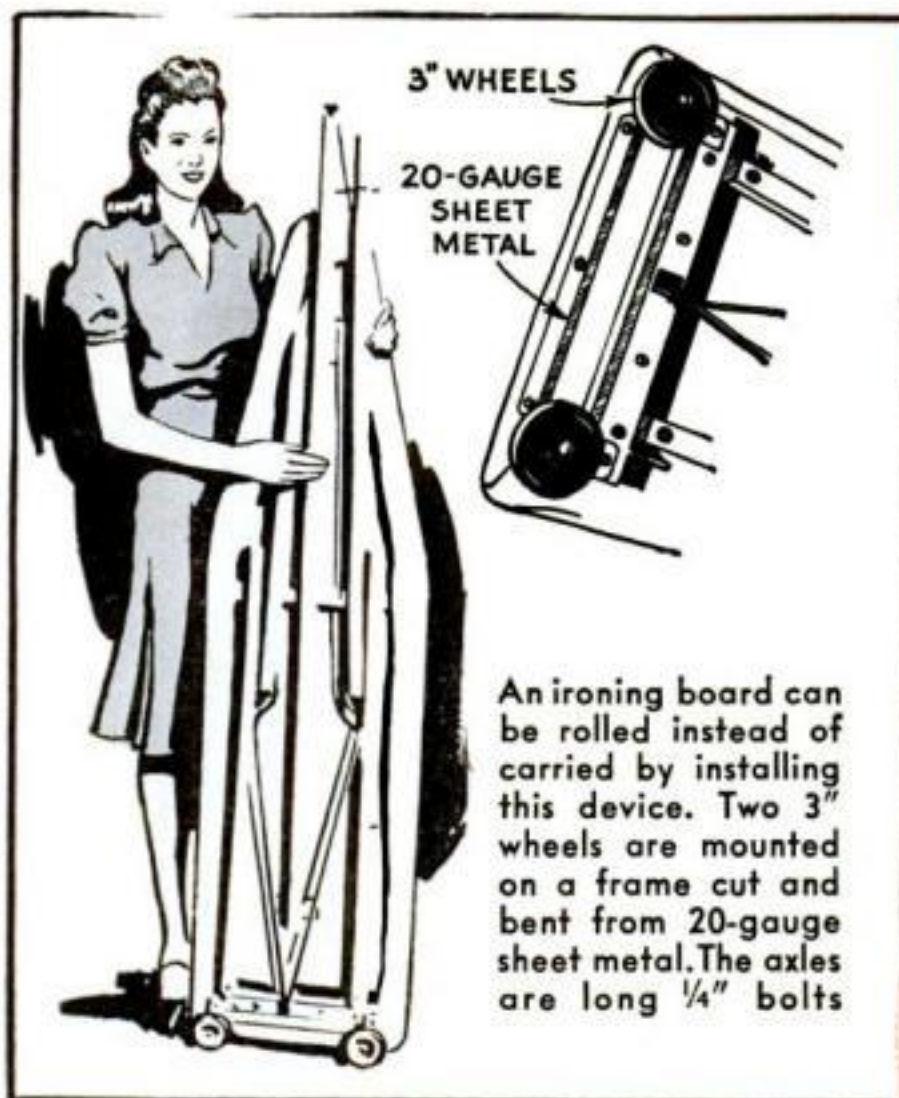
[ FORMULAS ]

A mixture of lanolin and castor oil is frequently used on the hands and arms of machinists susceptible to skin trouble caused by constant contact with lubricating oil. This type of "extra skin," however, is not so suitable for those doing general work about the shop, garage, or home.

A good protective cream for all-around use can be made from one part by volume of gum arabic, placed in a wide-mouthed, covered container. Add only enough water to cover the drops of gum and allow to stand overnight; then stir in two parts (or more, if desired) of ordinary soap chips. This cream is applied to the hands and well rubbed in before beginning work. Afterwards it is easily washed off, along with all the dirt.

POPULAR SCIENCE MONTHLY SHOP DATA FILE





An ironing board can be rolled instead of carried by installing this device. Two 3" wheels are mounted on a frame cut and bent from 20-gauge sheet metal. The axles are long  $\frac{1}{4}$ " bolts



Silverware can be dried without wiping if held together with a heavy rubber band, rinsed in hot water, and then stood upright in a wire drainer



When filling your fancy salt and pepper shakers, use cellulose tape instead of corks to seal them

# KEEPING

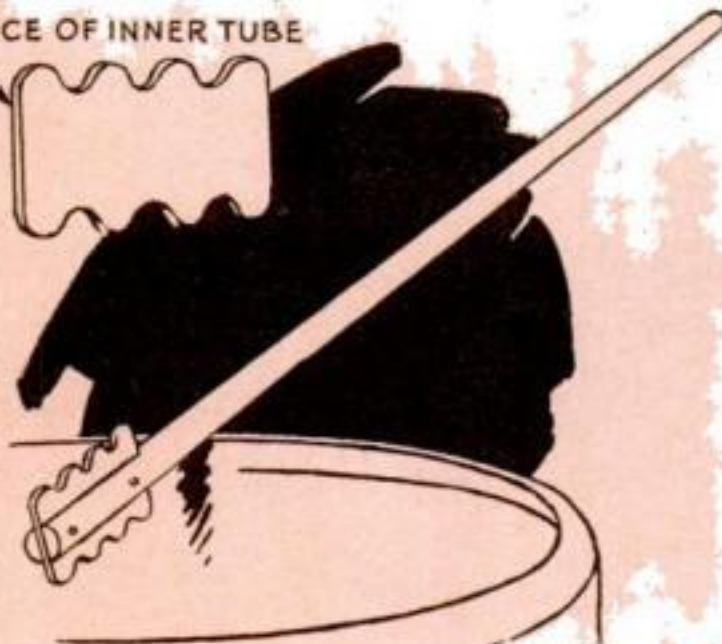


A piece of rubber splicing tape wrapped around the end of a screw driver forms a tube to hold a screw while inserting it in an awkward place



If the shoehorn has been mislaid, a handkerchief may be used. Place a corner in the heel of the shoe and pull as the foot is forced down

PIECE OF INNER TUBE



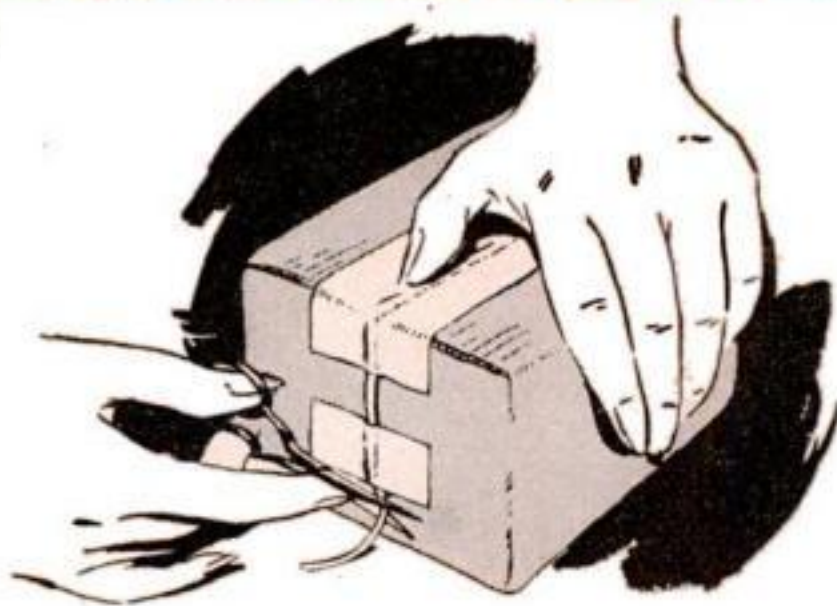
Handkerchiefs and similar articles can easily be fished from the wash boiler or laundry tub if rubber fins are added to the stirring rod



# THE HOME SHIPSHAPE



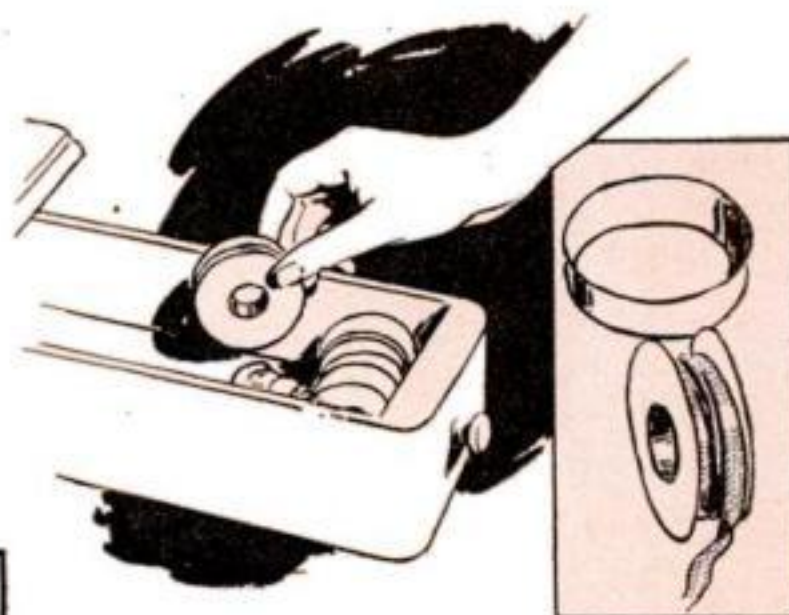
**1/8" WOOD** Extra shelf space for safety razor, blades, tubes of shaving cream and tooth paste, and similar items can be added to many wooden medicine cabinets



Placing cord under the tape of a sealed package makes it easier for the recipient to open it. For the low postage rate, an opening-permit label must be attached



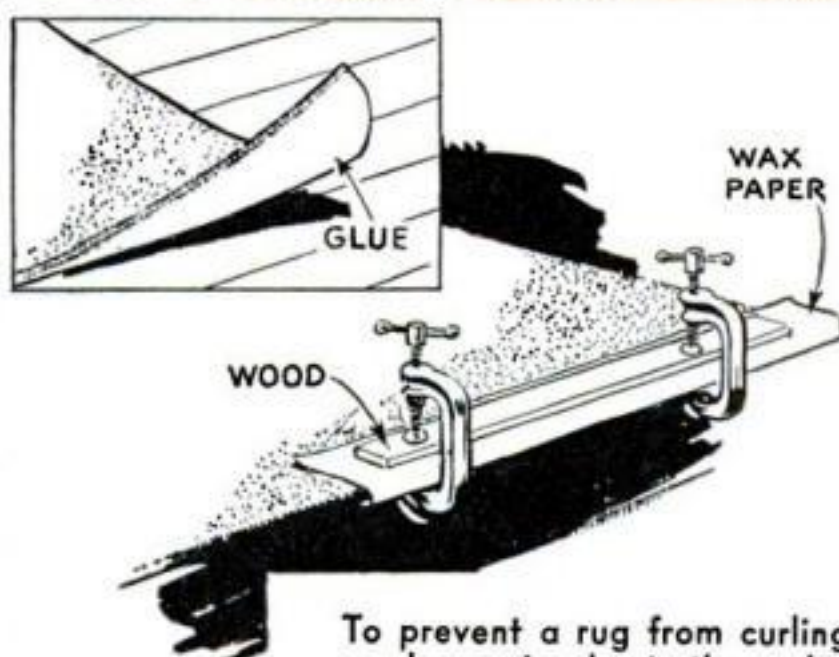
Protect your arm with a pot holder when stirring over a hot stove



Wind odd pieces of lace, braid, and elastic around empty adhesive-tape containers so they can be stored neatly in drawers



If the lower window sash sticks, pull out the two sash cords and let them snap back



To prevent a rug from curling, apply casein glue to the under-edge, fold wax paper over it, and clamp between two strips of wood until the glue dries



# WHAT DEFECTS TO LOOK FOR

## A Room-by-Room Check List for Home Owners

		Hall Down	Hall Up	Living Room	Dining Room	Bedroom No. 1	Bedroom No. 2	Bedroom No. 3	Kitchen	Bath No. 1	Bath No. 2	Den or Porch	Maid's Room	Base- ment
<b>FLOORS</b>														
WOOD	Squeaking													
	Shaking													
	Cracks													
	Baseboard cracks													
CONCRETE	Worn finish													
	Dusting													
	Cracked													
LINOLEUM	Rough													
	Worn													
	Dull													
	Torn													
<b>WALLS</b>														
PLASTER	Cracked													
	Stained													
WALL BOARD	Warped													
WALL PAPER	Open joints													
	Old													
<b>CEILINGS</b>														
PLASTER	Cracked													
	Stained													
	Loose													
<b>WINDOWS</b>														
WOOD	Water leaks													
	Air leaks													
	Loose													
	Tight													
	Failing paint													
	Poor putty													
	Broken catches													
	Warped													
METAL	Water leaks													
	Air leaks													
	Worn hardware													
<b>DOORS</b>														
INSIDE	Sticking													
	Loose													
	Warped													
	Worn hardware													
OUTSIDE	Air leaks													
	Water leaks													
	Poor fit													
	Worn hardware													
<b>TRIM</b>														
	Open joints													
<b>TILE WORK</b>														
	Loose													
	Discolored													
<b>WIRING</b>														
	Cords frayed													
	Fixtures shabby													

## FOR SPECIAL ATTENTION: STAIRS, HEATING, AND PLUMBING

### STAIRS

- ☐ Squeaking
- ☐ Weak handrails
- ☐ Poor illumination

### HEATING

- ☐ Poor distribution
- ☐ Drafts
- ☐ Cold areas near windows
- ☐ Cold, exposed rooms
- ☐ High fuel consumption
- ☐ Cold floors and walls

### CHIMNEY DRAFT

- ☐ Smoking heater
- ☐ Smoking fireplace
- ☐ Poor draft in heater
- ☐ Draft control ineffective

### STEAM-HEAT SYSTEM

- ☐ Radiator not heating
- ☐ Noisy pipes
- ☐ Slow heating

- ☐ Water level drops

- ☐ Noise in boiler

### HOT-WATER SYSTEM

- ☐ Uneven distribution
- ☐ Cold radiator

### HOT-AIR SYSTEM

- ☐ Uneven distribution
- ☐ Dust

### HEAT LOSS

- ☐ High fuel consumption
- ☐ Overheated cellar
- ☐ Loss at windows
- ☐ Loss through ceilings and walls
- ☐ Loss through air leaks

### PLUMBING

- ☐ Clogged water pipes
- ☐ Corroded water pipes
- ☐ Clogged drain pipes
- ☐ Clogged cesspool

- ☐ Septic tank not working

- ☐ Noisy piping

### HOT-WATER SUPPLY

- ☐ Insufficient hot water from pot stove, indirect heater, firebox coil, or gas or oil heater
- ☐ Water rusty and dirty
- ☐ Noise in supply tank
- ☐ Variable flow

### WATER OUTLETS

- ☐ Leaking flush-tank valves
- ☐ Leaking faucet washers
- ☐ Dull finish of exposed piping

### DAMPNESS

- ☐ Leaks in cellar walls and floor
- ☐ Cellar condensation
- ☐ Condensation on pipes and flush tanks
- ☐ Condensation on walls and ceilings
- ☐ Condensation on window glass



# Your House NEEDS A Check-Up

By  
**ROGER B. WHITMAN**

Home-building expert and author of  
*First Aid for the Ailing House*

KNOW a home owner whose chief hobby is his house. He is so familiar with every little detail, inside and out, that he notices any change in it. This may be a new crack appearing between two floor boards . . . a drop of water forcing its way through window-pane putty . . . an unexpected noise in the plumbing or the oil burner . . . the loosening of a roof shingle . . . the burning of more oil than the temperature warrants . . . a creak in the stair. To him, any one of these and many other things means added and unnecessary expense, or a beginning of deterioration that should be stopped before it leads to real trouble. As a hobby it is one of the most sensible, for not only is it a money-saver in maintenance, but it maintains the security of his investment.

Few owners are so well acquainted with their houses that they can recognize the beginnings of deterioration. They do not realize that some imperfection, apparently trifling, may develop into serious damage. Yet in the keeping up of a house, it is the little



Windows that stick are one of life's little annoyances. Too loose is even worse, because then they waste fuel

things that should be given attention; the beginning of a split in a clapboard may, if left alone, result in a water leak and the eventual rotting of an important timber. I have been shown through houses by proud owners whose eyes were so taken by surface decorations and effects that they were oblivious to cracks in the foundation walls and the dripping of corroded water pipes. One, I remember, explained the good points of his stoker, but was quite unmoved when I opened a door of the boiler and found that the flue passages were nearly clogged with fly ash and soot.

Home owners who have no deeper knowledge of their houses than surface finishes and decorative effects are the ones who com-



With the check list, you can discover all the faults of a house so they can be remedied one at a time



plain of the high cost of ownership. It is not that they do not want to know. The trouble lies in their never having had an opportunity to learn the construction of a house, the functions of the parts, the relation of one part to another, and the ways in which the parts are put together. If they eventually learn, it is usually through bitter experience.

The accompanying check list of the possible failures of the more important parts of a house is intended as a guide to home owners who are interested in overcoming deterioration and in keeping their houses in good condition. It contains only a few references to the finishes of floors, walls, and other surfaces, for these are obvious.

To make use of the check list, an owner should go over his house room by room and note the condition of each detail. This will enable him to set about the work of renovation systematically. He might complete all of the work in one room at a time, but will probably find it simpler to make one job of repairing all plaster cracks or adjusting all doors and all windows, or refinishing all floors.

An owner who is careful of his property will make a detailed examination once every month or two, taking a rainy Sunday morning for it, or some other time when he has

nothing else on his mind. He can well begin in the attic, with a flash light to use in the dark corners. When he knows the appearance of the underside of the roof, for an example, a stain that was not there on his previous visit will catch his eye and start him hunting for the cause. Quite likely, it shows the beginning of a roof leak, which, when caught at so early a stage, can be prevented from developing into something serious and expensive.

Each room should be looked over—floor, walls, ceiling, windows, and every other part. After a few such studies the owner will be so well aware of the normal appearance of every section of the entire house that any change will be apparent, and will set him to learning the cause and the remedy. The check-up should not take more than an hour or so, and even if it takes a morning at first, it is not too much time to give to safeguarding so large an investment.

Knowledge of a house has other advantages. A suburban housewife, alone in the house one morning, was doing something in the kitchen when she was startled by the noise of water in the hall. Running out, she saw a cataract of water coming down the stairs from a burst pipe in the bathroom. Her husband had always taken care of the mechanical parts of the house, and while she

knew that there was a shut-off valve in the cellar, she had no idea where to find it. She ran to the front door, hoping to see someone who could help her, but there was nobody in sight. She did not know the name of the plumber, so finally, in desperation, she telephoned the police. It was a quarter hour or more before an officer came and turned off the water, and by that time, parts of the house were thoroughly soaked. In the end, a new floor had to be laid, a fallen ceiling replaced, and other damage repaired.

A friend of mine, who had just moved into a new house, heard the story and took steps to avoid such a tragedy. He tied a baggage tag to every valve, handle, switch, and other operating mechanism in his cellar, each with the proper label: "This shuts off all the water in the house"; "This shuts off the hot water in the second-story bathroom"; "This shuts off the gas"; "This shuts off the electricity"; "This lets water into the boiler," and so on. Then he brought his wife, his two half-grown children, and the maid into the cellar, explained each tag, and made each member of the household experiment with turning things on and off.



If you make regular inspections, you'll notice every slight change. A new stain under the roof may warn you in time to prevent a bad leak and costly repairs

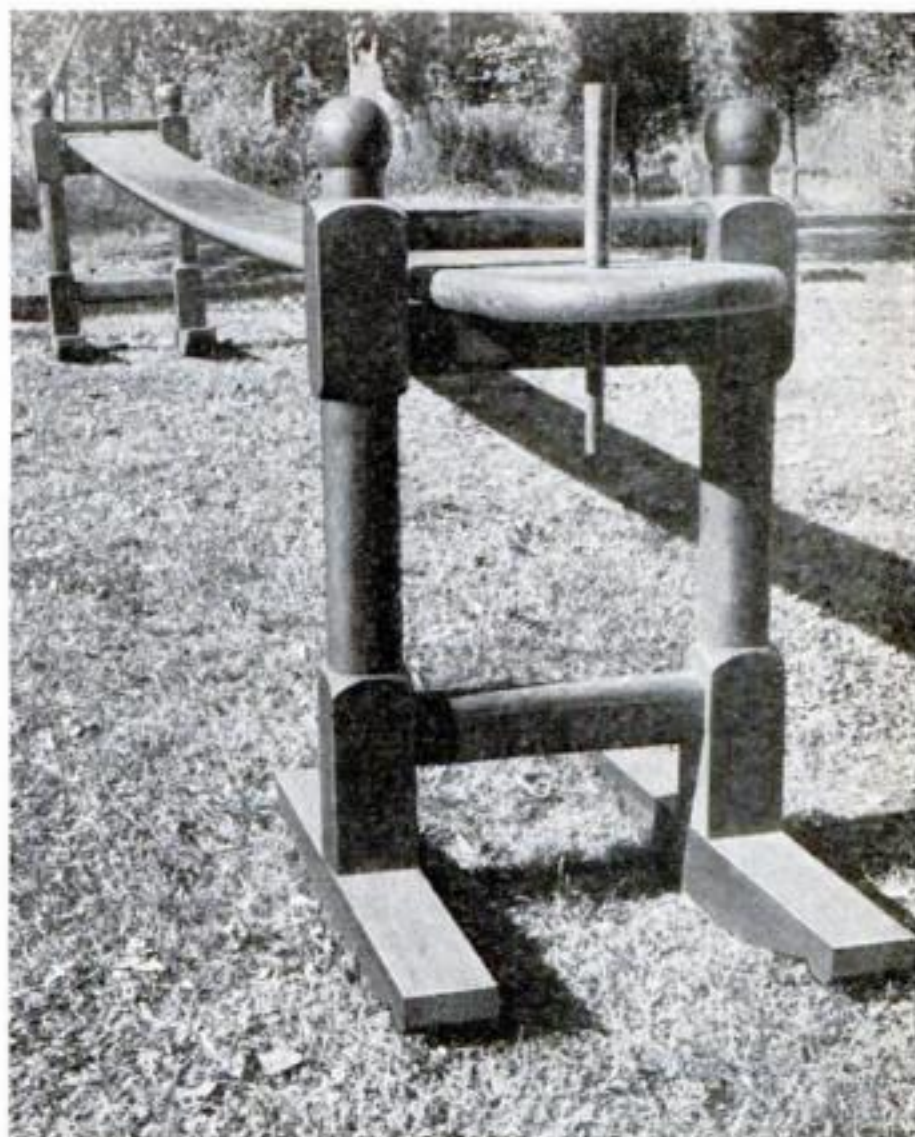


# JOGGLING BOARD

**T**HE joggling board, an old South Carolina institution which is more fun than a couple of barrels of monkeys on a seesaw, is beginning to find its way to homes in other parts of the country. Visitors to Charleston and the plantations of the South Carolina low country see southern children and their elders joggling away in great glee and are immediately won over to this curious means of play and exercise. Some have one made and shipped home. Others take the measurements and make one themselves.

Instead of having a standard in the middle like a seesaw, the joggling board has one at either end. These standards are sturdy, and on the bottom of each are a pair of rockers. Between the standards extends a pine board from 18' to 24' long.

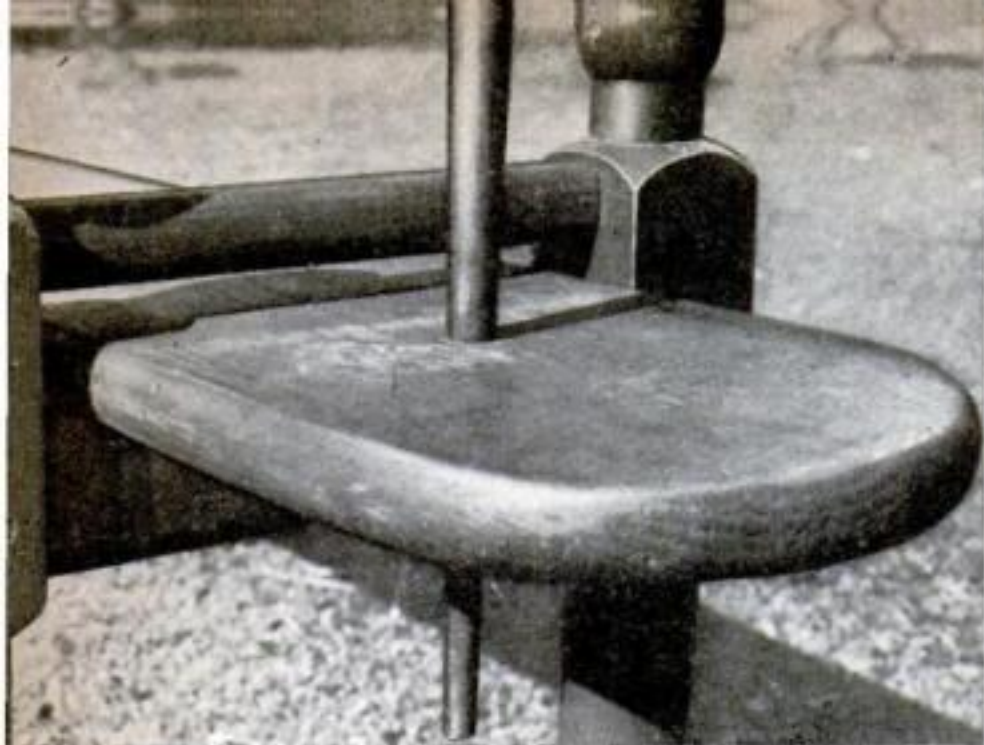
There are a number of ways in which



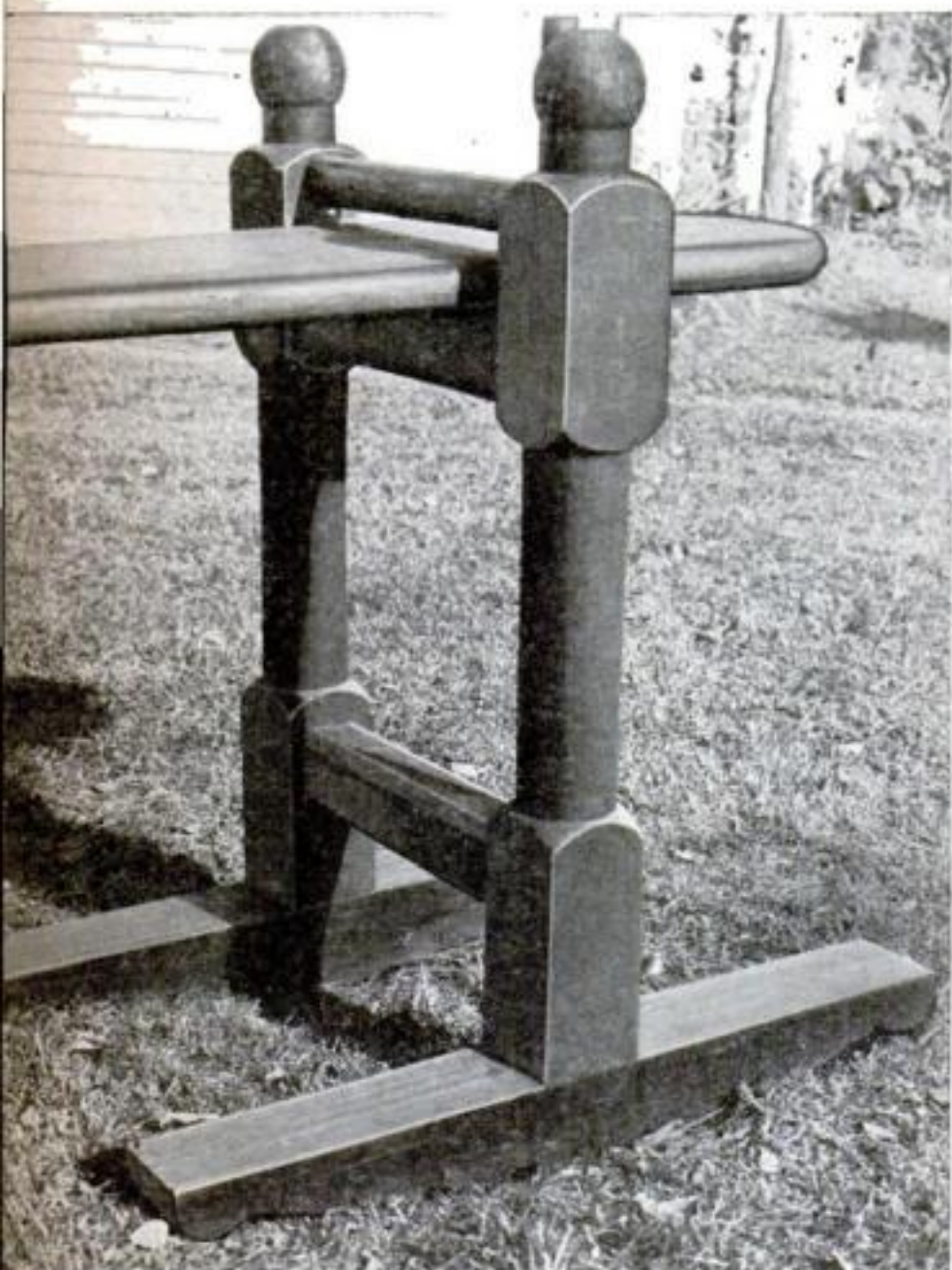
Popular in South Carolina for a hundred years, joggling boards are now being copied in many parts of the country. When the board is set in motion, the jogger's body follows an elliptical course. The board above is 18' long and is made of yellow pine



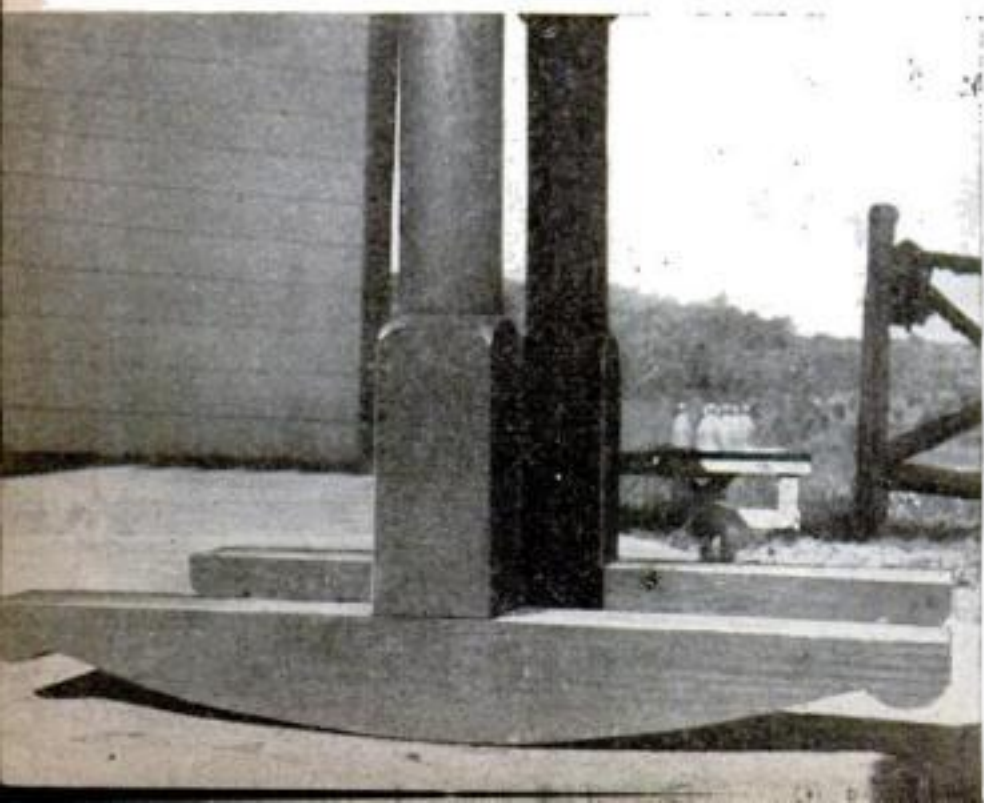




A tapered pin prevents the board from sliding out



Close-up of the standards and, below, the rockers



a joggling board may be used, and a wide variety of games may be played on it. The juggler sits in the middle of the board, which is about 2'6" above the ground. By posting, as when riding a horse, he starts the board in motion. Soon he is bouncing, or joggling, up and down briskly.

As the vertical motion of the board increases, the juggler begins to leave the board each time it rises. When this happens, he feels like a soaring bird on each ascent. By shifting his weight as he joggles up and down, he starts the joggling board swinging back and forth on its rockers. As a result of this, the juggler's body begins to follow an elliptical course.

It is more fun when two or more persons joggle at the same time. It is surprising how much weight a southern pine board can hold. Three, or even four persons, can joggle at the same time.

Children take to the joggling board immediately and invent all sorts of games to play. Sometimes two or three will stand up and joggle. The object of this game is to see who has to jump off the board first.

When set up on the lawn, the joggling board becomes not only a plaything for the children, but a bench where more sedate adults may sit and rest.

Joggling boards have been used in South Carolina for more than 100 years, and generations of children have played on them. They are to be seen on the verandas of old southern mansions in Charleston. They are to be found at many of the old plantations in the low country. Some of them have been used by families for seventy-five years or more and are still going strong.

Some of the joggling boards at the plantations are 22' or 24' long, and from many years of usage the boards are almost as springy as steel. In the old days the boards were made of southern long-leaf pine; nowadays they are made of yellow pine, which is almost as good.

As it is of simple construction, a joggling board may be assembled without difficulty by following the dimensions given in the accompanying drawings. Suitable lumber may be obtained at almost any lumberyard, but care should be taken in the selection of the board itself. This should be straight-grained and without knots, cracks, or other defects. The better the board used, the more weight it will carry and the more spring it will have. The board is usually 1 $\frac{5}{8}$ " thick, but if it is to be used only by children it may be 1 $\frac{1}{2}$ " thick. It is better to have it planed to the greater thickness because, although you may intend it for the children, you will find that most of your adult visitors will want to try it.

If a lathe is available, the upright members used in making the end supports may be turned as shown; otherwise they may be left square except for rounding or chamfering the







# A Dressing



ONLY in the more expensive furniture stores could you find the equal of this distinctive modern dressing table and bench. Its appeal is based upon a well-proportioned and simple exterior and the careful selection of wood for grain and color. A light wood such as birch, maple, or blond walnut is suitable.

Note that the drawer pulls and door handle are eliminated. This function is taken over by the beveled lower edges of the drawer fronts and the left edge of the door. The groove thus formed plays an important part in producing a pattern on an otherwise severely plain piece. The three upper drawers must be carefully fitted to preserve the groove line intact. A false groove is carried across the door, which is hung on invisible type hinges. The bevel on the upper edge of the drawers should be made after they are completely assembled.

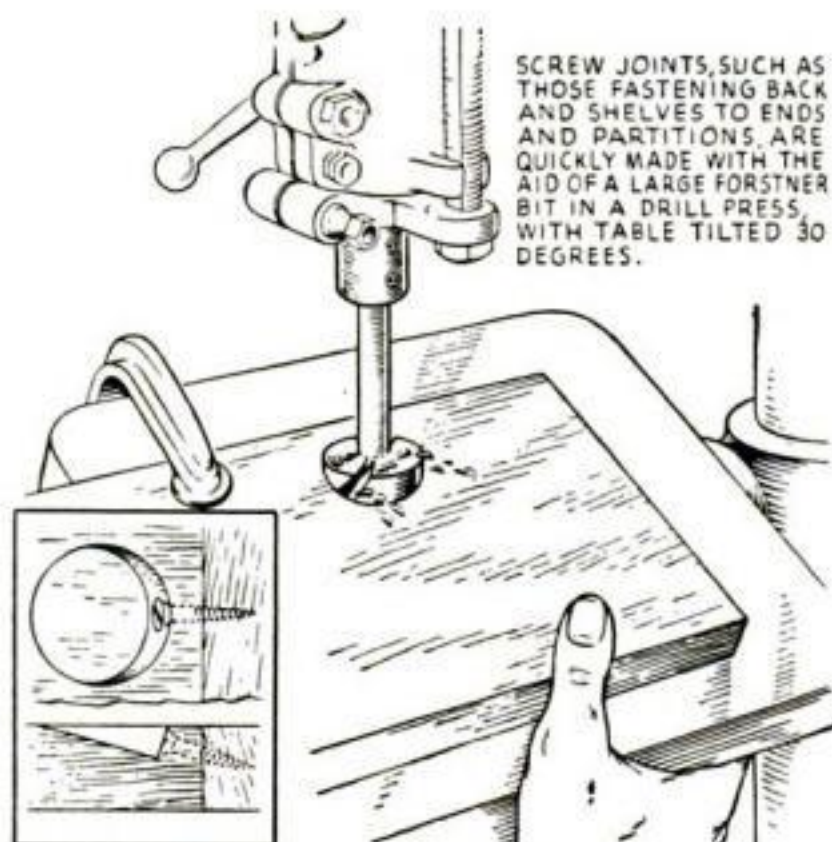
The center drawer, not detailed, is similar to the others except that the front is flush with the sides at both ends. The front joints are the same as detailed at the left in the drawer that is shown in detail. Note the locking strip in the right-hand detail.

## LIST OF MATERIALS FOR TABLE

No. Pc.	Description	Thickness	Width	Length
1	Top	$\frac{3}{4}$	17	40 $\frac{1}{2}$
2	Ends	$\frac{3}{4}$	18	30
1	Back	$\frac{3}{4}$	22 $\frac{1}{4}$	40 $\frac{1}{2}$
2	Vertical partitions	$\frac{1}{2}$ ply	15 $\frac{1}{2}$	22 $\frac{1}{4}$
1	Door	$\frac{3}{4}$	11 $\frac{1}{4}$	16 $\frac{3}{4}$
2	Upper drawer front	$\frac{3}{4}$	4 $\frac{1}{4}$	11-3/16
1	Center drawer front	$\frac{3}{4}$	4 $\frac{1}{4}$	17-15/16
1	Middle drawer front	$\frac{3}{4}$	7 $\frac{1}{4}$	11-3/16
1	Lower drawer front	$\frac{3}{4}$	9 $\frac{1}{4}$	11-3/16
2	Lower drawer sides	$\frac{1}{2}$	8-11/16	15 $\frac{3}{8}$
2	Middle drawer sides	$\frac{1}{2}$	6-11/16	15 $\frac{3}{8}$
6	Upper and center drawer sides	$\frac{1}{2}$	3-11/16	15 $\frac{3}{8}$
2	Upper drawer back	$\frac{3}{4}$ ply	3-3/16	9-15/16
1	Center drawer back	$\frac{3}{4}$ ply	3-3/16	17-3/16
1	Middle drawer back	$\frac{3}{4}$ ply	6-3/16	9-15/16
1	Lower drawer back	$\frac{3}{4}$ ply	8-3/16	9-15/16
4	Up., mid., low., dr. bottoms	$\frac{1}{4}$ ply	9-15/16	15 $\frac{1}{2}$
1	Center drawer bottom	$\frac{1}{4}$ ply	17-3/16	15 $\frac{1}{2}$
2	Shelves	$\frac{3}{4}$	15 $\frac{1}{2}$	10 $\frac{3}{4}$
1	Top rail	$\frac{3}{4}$	1 $\frac{1}{4}$	40 $\frac{1}{2}$
8	Intermed. rails—front and back	$\frac{3}{4}$	1 $\frac{1}{4}$	10 $\frac{3}{8}$
8	Side rails	$\frac{3}{4}$	$\frac{7}{8}$	14-1/8
4	Top cleats	$\frac{3}{4}$	$\frac{7}{8}$	14-5/8
2	Center drawer rails	$\frac{3}{4}$	$\frac{7}{8}$	15 $\frac{1}{2}$

## FOR BENCH

2	Ends	$\frac{3}{4}$	15	18
2	Side stretchers	$\frac{3}{4}$	3 $\frac{1}{2}$	21 $\frac{1}{2}$
4	Corner blocks	$\frac{3}{4}$	4	4
2	Seat frame—sides	$\frac{3}{4}$	1 $\frac{1}{2}$	17 $\frac{1}{4}$
2	Seat frame—ends	$\frac{3}{4}$	1 $\frac{1}{2}$	13 $\frac{3}{4}$



SCREW JOINTS, SUCH AS THOSE FASTENING BACK AND SHELVES TO ENDS AND PARTITIONS, ARE QUICKLY MADE WITH THE AID OF A LARGE FORSTNER BIT IN A DRILL PRESS, WITH TABLE TILTED 30 DEGREES.

MODERN STYLING • DISTINCTIVE DESIGN



By  
**DONALD A. PRICE**





# WORKBENCHES

**N**O MATTER what kind of home workshop you have, there is really nothing more important in it than the workbench. You may have all sorts of machine tools, yet you still have to spend much of your time fitting and assembling at the bench.

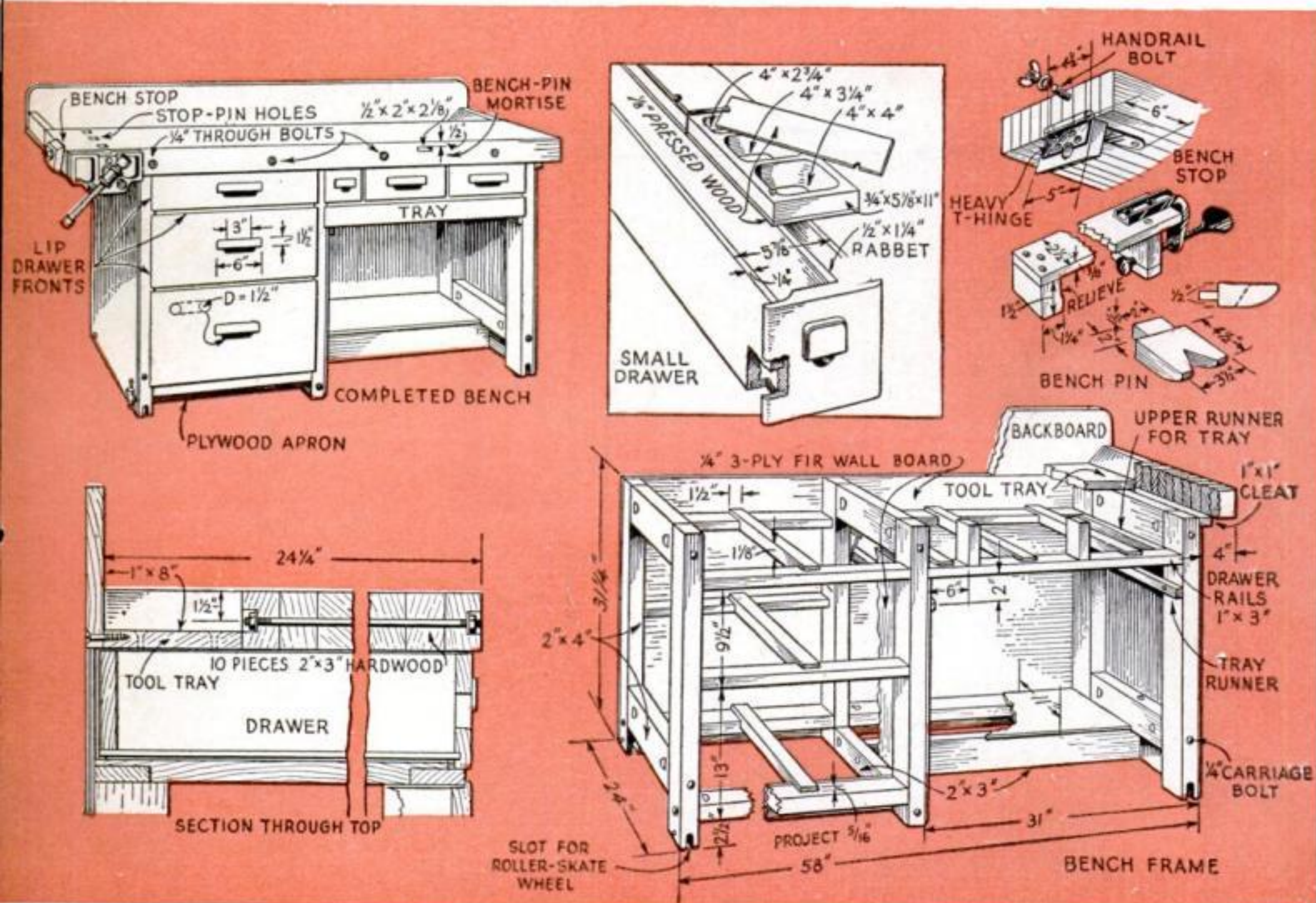
This month we present a new workbench designed especially for the POPULAR SCIENCE model home workshop. It differs somewhat from a standard cabinetmaker's bench, since it is adapted to such widely varying work as building garden furniture or intricate ship models. The most obvious change is the omission of a tail vise, but a special stop makes up for this and saves buying the extra unit.

The top is glued up from 2" by 3" hardwood stock, preferably maple, although birch, oak, or even fir may be substituted. Such a top, carefully made, will last a lifetime. It is often possible to buy good used material at a fraction of the cost of new stock. Four  $\frac{1}{4}$ " iron rods, threaded at both

ends and provided with nuts and washers, pass through the top from edge to edge. They should be cut long enough to project  $\frac{1}{2}$ " at each end.

Expense can be saved by ordering rough stock and sizing it on a power jointer, if available. Also, thicker and wider sticks are obtainable than if dressed material is purchased. Although the thickness may be random, the width of all pieces must be equal. Lay them edge up on the floor, one end even, and square lines across where the bolts are to be. Square across the faces and gauge from the upper edges to locate the bolt holes for boring.

Unless a helper and plenty of clamps are at hand, do not attempt to use hot glue. Casein glue is better. Insert the iron rods in the first stick, coat the face with glue, and apply glue to the joining face of the second piece. Thread it on the rods, and proceed until the assembly is complete. Tighten the bolts and group such clamps as are at hand around one bolt, placing them

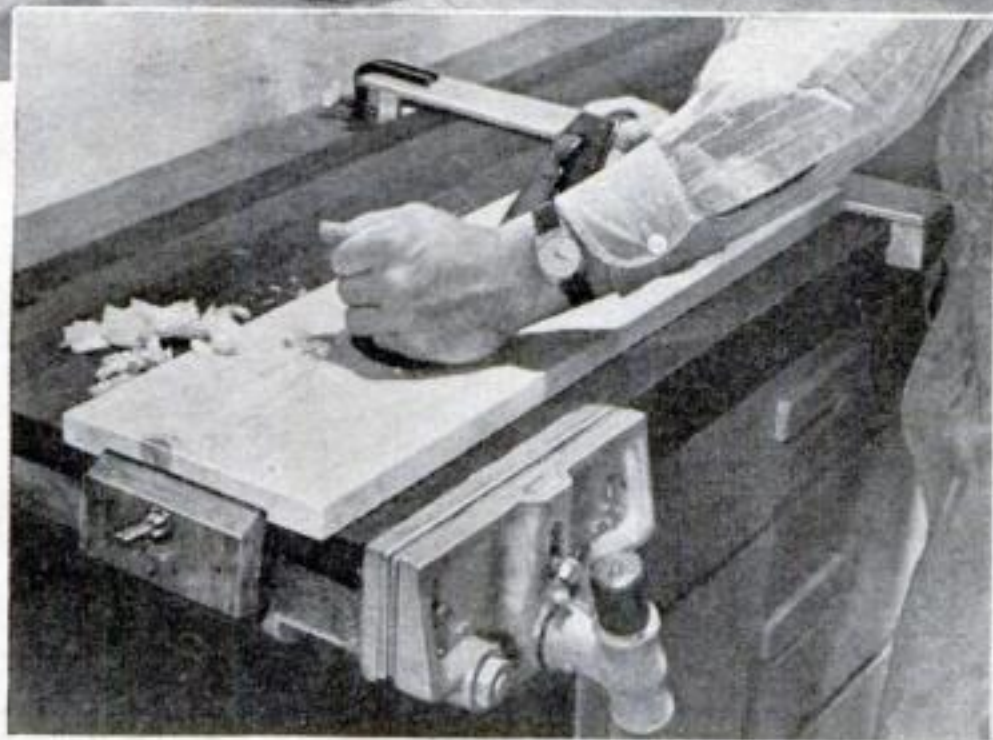




# for the HOME SHOP



By EDWIN M. LOVE

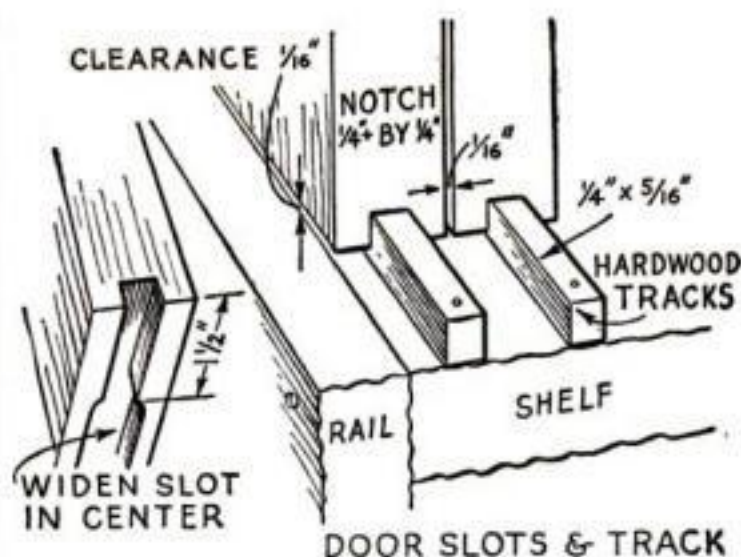


At top, Robert Jaacks at the Popular Science model workbench. Above, planing a wide board secured with a clamping stop and small bar clamp

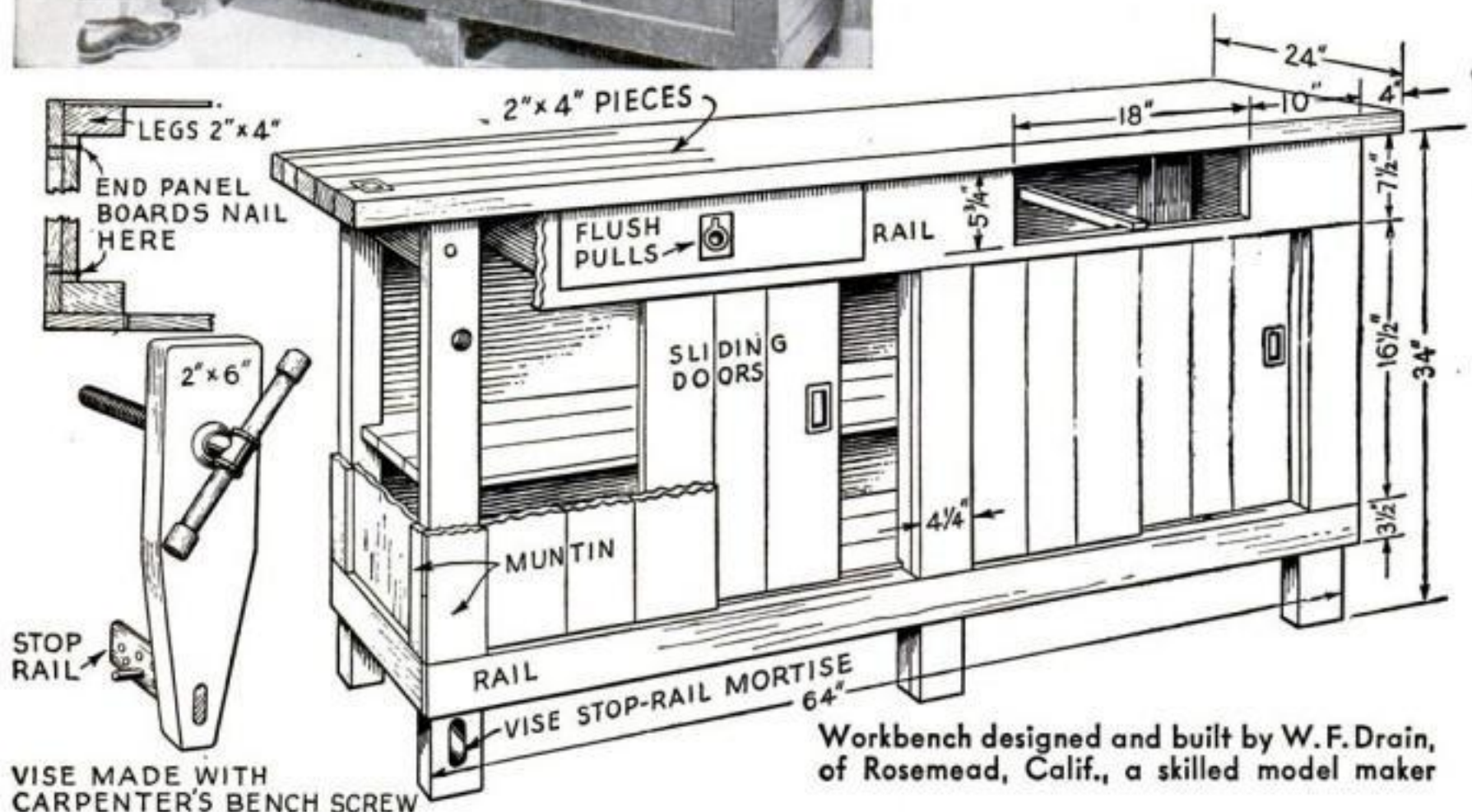
Leveling off the top of the workbench. The top is composed of 2" by 3" hardwood stock glued together and reinforced with four 1/4" iron rods







The cupboards are closed by sliding doors, which run on hardwood tracks.



Workbench designed and built by W.F. Drain, of Rosemead, Calif., a skilled model maker

on both sides of the slab. Tighten the nut, remove the clamps, and treat the next bolt similarly. Go over them all two or three times in the same way.

Now wipe off the squeezed-out glue and rest the slab on sawhorses. Lay a strip of wood across each end, and sight over them to detect any wind (twist). This can be largely taken out by driving down the high corners with a hammer and block. Replace the clamps and set the top aside to dry for at least twelve hours.

The heavy members of the frame are assembled with draw-bolt joints (P. S. M., Dec. '40, p. 184). Brace the assembly with diagonal strips of wood and cover the back with  $\frac{1}{4}$ " plywood wall board attached with dabs of glue and short nails. Also sheathe the partition and put in the shelf. Notch the drawer runners over the rails, being careful to square them with the front.

Fix the top to the frame with a cleat screwed at each end. Let it lie loosely on the frame, level it with wedges, and screw

the cleats to the frame. After the ends have been covered with plywood, the bench will be found to be thoroughly rigid.

Smooth the top by planing diagonally, and finish with lengthwise strokes. Occasionally test it for wind, and check with a straightedge. Scrape smooth, cut the ends to length, and sandpaper. Fit the vise by notching the fixed back jaw into the edge of the top. It is a good idea to face the jaw with a thin board, such as a piece of plywood. The notch should be deep enough to bring the wooden pad about flush with the edge. Screws also enter the underside of the top, and according to the thickness of the top and construction of the vise, the top will have to be notched beneath, or possibly shimmed out, to suit.

Vises are obtainable in several sizes and qualities. The type used for our model bench, retailing for about \$4.50, has 10" jaws that are 3" deep and open to 9", with an adjustable stop pin in the front jaw. Quick-acting vises that slide in and out at



a partial turn of the handle, and lock and clamp with a half turn or less, cost \$9 up. They are timesavers and desirable if the money can be spared. Make stop holes in the end of the top by boring 1" holes and squaring them with a chisel. Cut a 4" long pin to fit.

The drawing clearly details the bench stop. It is a hardwood flap screwed to the T-leaf of a heavy hinge, which in turn is mounted under the top. Through a hole in the stop a handrail screw with a lag-screw

thread is passed and screwed into a suitable hole bored in the top.

Make a bar-clamp as shown. Saw through the frame of an inexpensive C-clamp and bolt it to the end of a hardwood strip. The screw is blocked to keep it from springing outward under pressure.

Fit the rest of the frame parts and add the tray cleats at the sides of the knee opening. The tray bottom is let flush into a rabbet in the tray frame, and small cleats are nailed beneath near the ends to afford handholds for drawing it out.

The small drawer above also has its bottom rabbeted in. The front projects 1/4" below to close the opening at the bottom. A pair of triple trays for small brads rest in rabbets made in the upper edges of the drawer sides.

The drawers are lipped, with ends and tops lapping 1/4" over the sides and rails. Round the corners to 1/4" radius. The upper drawers, since they close under the top, have no upper lips; otherwise the construction is standard.

Remove the top bolts and counterbore to sink the nuts. If the nuts are screwed on the rods before cutting the latter to length, the threads will be cleaned as the nuts are backed off.

Screw down the tool-tray board, screw the backboard to its back edge, and fit beveled blocks at the ends to make it easy to sweep the tray.

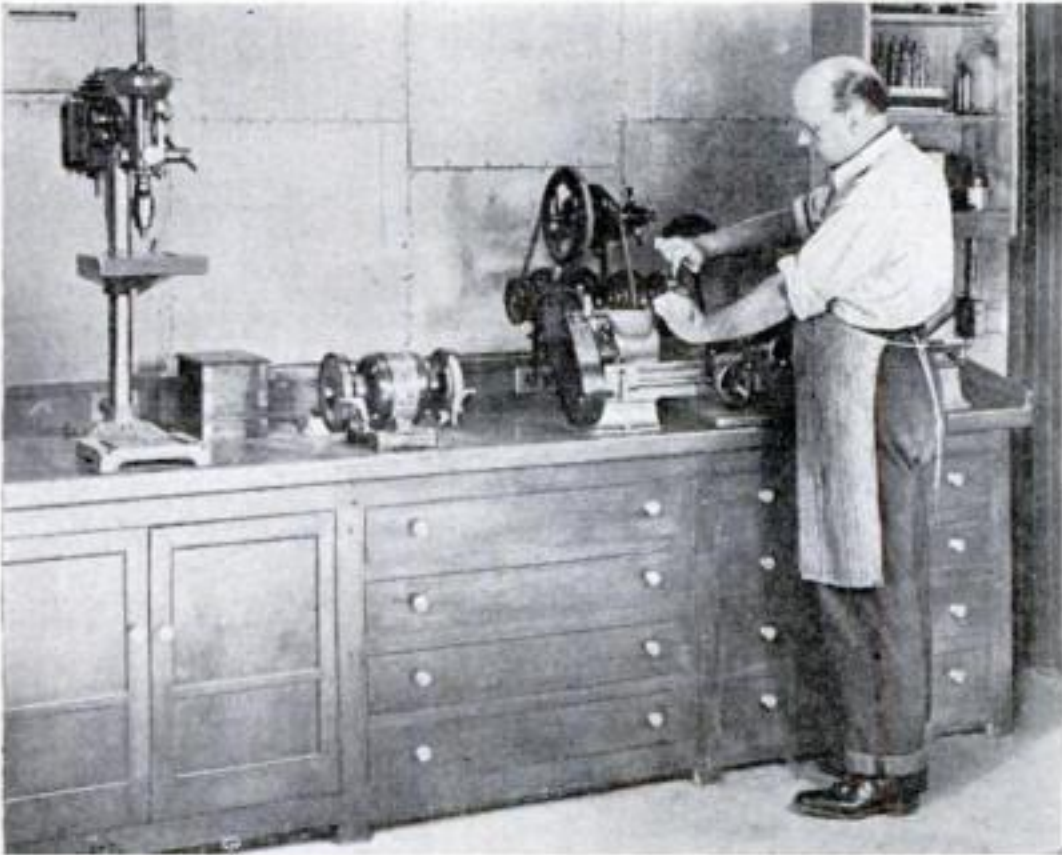
A good bench deserves a good finish. Prime the top with equal parts of pure turpentine and four-hour floor varnish, dry twenty-four hours, and sand lightly with 4/0 garnet paper. Then dust off and finish with full-body four-hour floor varnish, gloss or egg-shell. Dry three days before using. Color is the modern trend in shops, but a natural finish is satisfactory for the body. Rub the lower edges of the drawers and also the runs with soap or paraffin for easy sliding.

There are, of course, many other excellent ways to build a workbench, and plans are given for one designed by Walter F. Drain, of Rosemead, Calif., a skillful craftsman and model maker. It is equipped with two drawers and two cupboards closed by sliding doors. In this case the vise is an inexpensive one made with a carpenter's bench screw.

Materials for Popular Science Workbench

Part	No.	Size (stock)	Length	Material
Top	10	2"x3" rough	72"	Hardwood
Stiles (legs)	6	2"x4" rough or S4S	31 1/4" net	Fir
Rails	1	2"x4" rough or S4S	48"	Fir
Rails	1	2"x4" rough or S4S	24"	Fir
Rails	5	2"x4" rough or S4S	17"	Fir
Rails	1	2"x3" rough or S4S	30"	Fir
Rails	1	2"x3" rough or S4S	17"	Fir
Tool tray and back	2	1"x8" S4S	72"	Fir
Drawer rails	4	1"x3" S4S	24"	Fir
Drawer rails	2	1"x3" S4S	30"	Fir
Drawer runners	6	1 1/8" net x 2"	24"	Fir
Drawer runners	4	1"x1" S4S	24"	Fir
Drawer fronts and sides	2	1"x12" S4S	8'	Knotty pine No. 2
Drawer fronts and sides	1	1"x12" S4S	4'	Knotty pine No. 2
Drawer fronts and sides	1	1"x10" S4S	8'	Knotty pine No. 2
Nail tray	1	1/8"x12"	24"	Composition
Drawer bottoms, sheathing	2	1/4"x48"	8'	3-ply fir wall board

Hardware: 4 iron rods, 1/4" diameter, 18" long, threaded both ends, with nuts and washers; 12 carriage bolts with nuts and washers, 5" x 1/4"; 1-6" x 1/4"; 7-3 1/2" x 1/4"; 4-2 1/4" x 1/4"; 1 T-hinge 4 1/2" wide; 1 handrail bolt; 1 small C-clamp; 1 1/2" flathead wood screws; 4 roller skate wheels, 2 door holders, 1 woodworker's iron vise.



Three of Mr. Drain's machines are mounted on a roomy cabinet. The top is covered with 1/8" pressed composition wood



# LATHE WORK



The thrill of unpacking a new metal-turning lathe soon gives way to greater thrills as its owner learns how to operate it

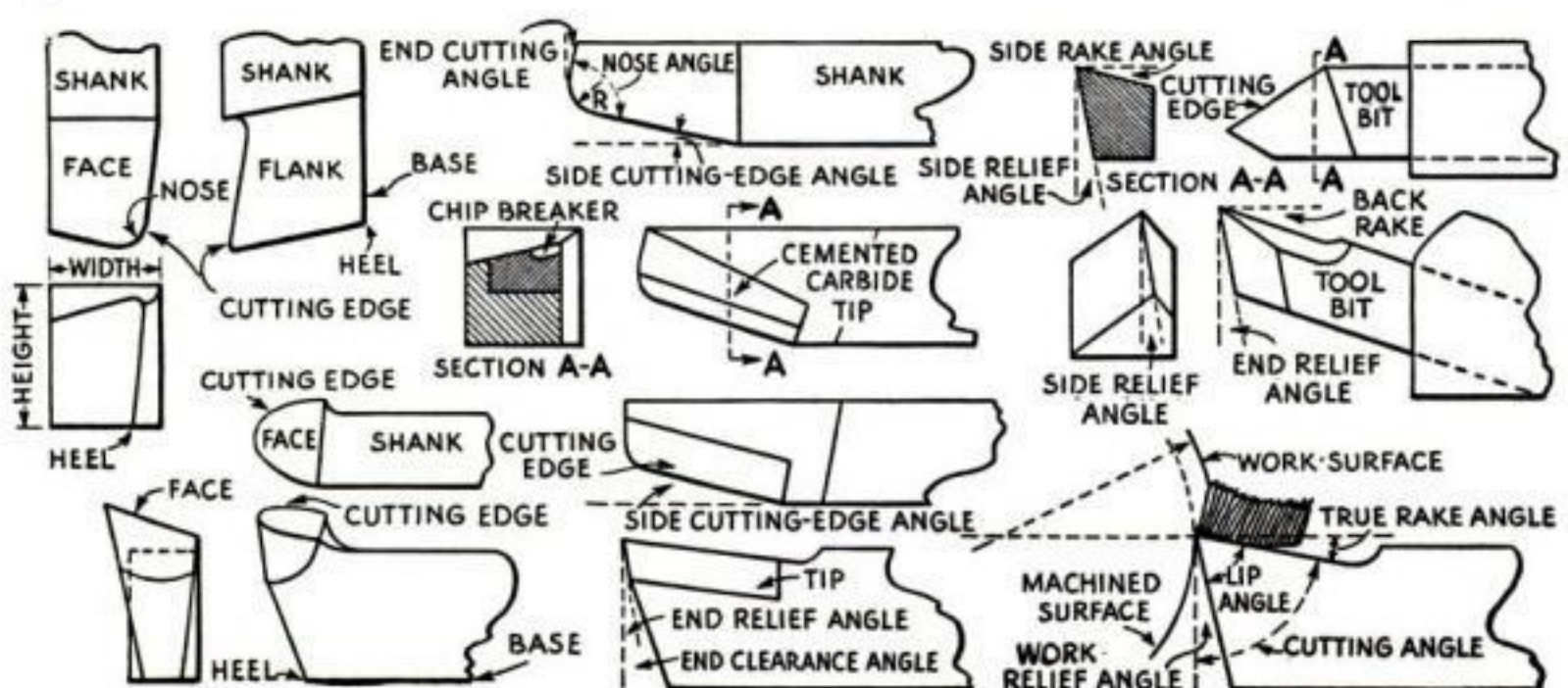
**T**HE primary tool of industry is the metal-turning lathe. This accounts for the emphasis always placed upon lathe work in trade and vocational schools. It is because the lathe is such a versatile and universally used tool that it is being added to the equipment of many thousands of home workshops each year.

No sooner is a new screw-cutting lathe unpacked and set up in a workshop, than the owner, unless he is already a thoroughly experienced mechanic, wants to know how to operate it skillfully. Moreover, even a well-trained mechanic sometimes forgets certain fine points connected with lathe operation and has to look them up.

To provide this information in tabloid form, so that it can be kept handy for ready reference, **POPULAR SCIENCE** is introducing this month a new section of its shop data file devoted to the lathe. This will insure a better understanding of lathe tools and their relation to the various operations required for everyday machine-shop work. The complete series will, in fact, serve as a short, up-to-date course in lathe work.

## NOMENCLATURE OF CUTTING TOOLS

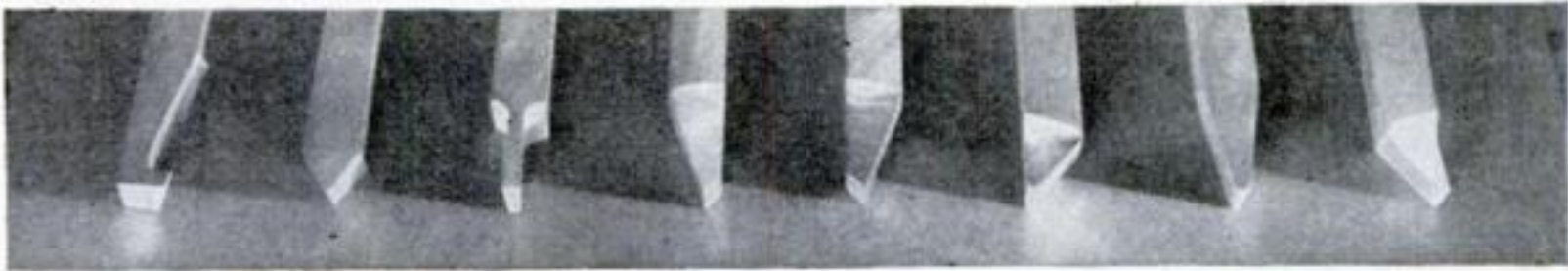
[ LATHE WORK—1 ]





## TOOL FORMS AND METHOD OF GRINDING [ LATHE WORK-2 ]

RECESSING    THREADING    CUT-OFF    L.H FACING    R.H FACING    R.H TURNING    ROUND NOSE    L.H TURNING



GRINDING RIGHT SIDE  
OF TOOL BIT

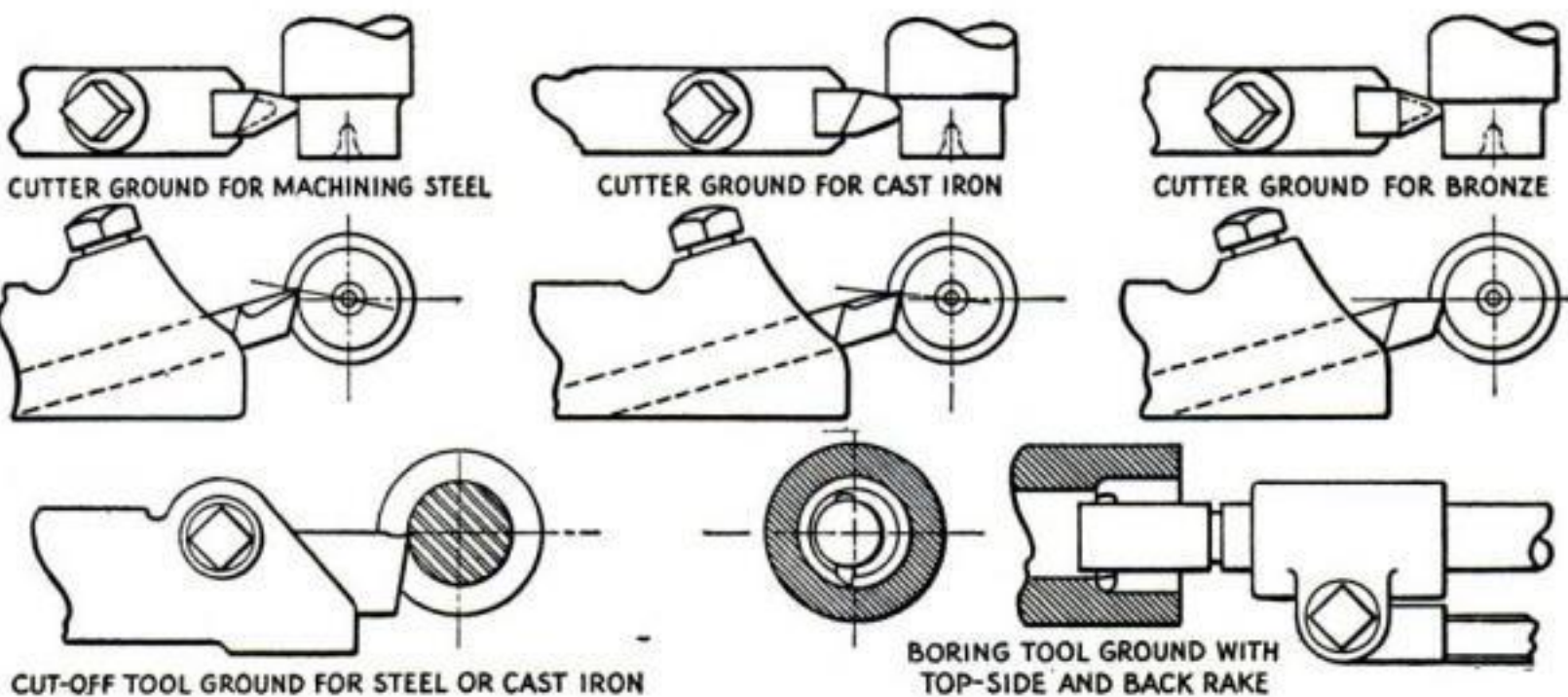
ROUNDING NOSE OF TOOL BIT

GRINDING  
TOP-SIDE RAKE

HONING CUTTING  
EDGE OF BIT

POPULAR SCIENCE MONTHLY SHOP DATA FILE

## GRINDING TOOLS FOR VARIOUS METALS [ LATHE WORK-3 ]



CUTTER GROUND FOR MACHINING STEEL

CUTTER GROUND FOR CAST IRON

CUTTER GROUND FOR BRONZE

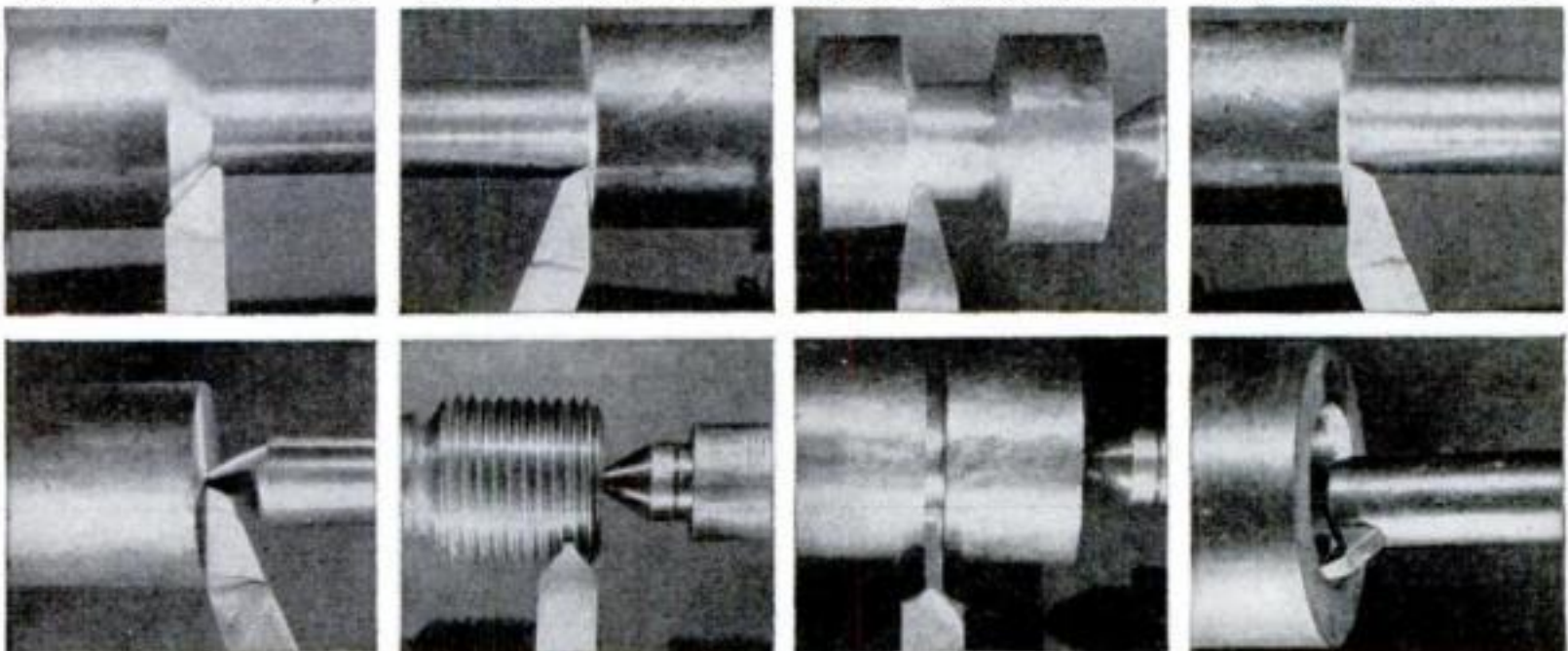
CUT-OFF TOOL GROUND FOR STEEL OR CAST IRON

BORING TOOL GROUND WITH  
TOP-SIDE AND BACK RAKE

POPULAR SCIENCE MONTHLY SHOP DATA FILE

## HIGH-SPEED STEEL TOOLS [ LATHE WORK-4 ]

RIGHT-HAND TURNING TOOL    LEFT-HAND FACING TOOL    ROUND-NOSE TURNING TOOL    RIGHT-HAND FACING TOOL



RIGHT-HAND FACING TOOL

THREADING TOOL

CUT-OFF TOOL

BORING TOOL

POPULAR SCIENCE MONTHLY SHOP DATA FILE



## Cutting Threads on Both Ends of Short Pipe Nipples

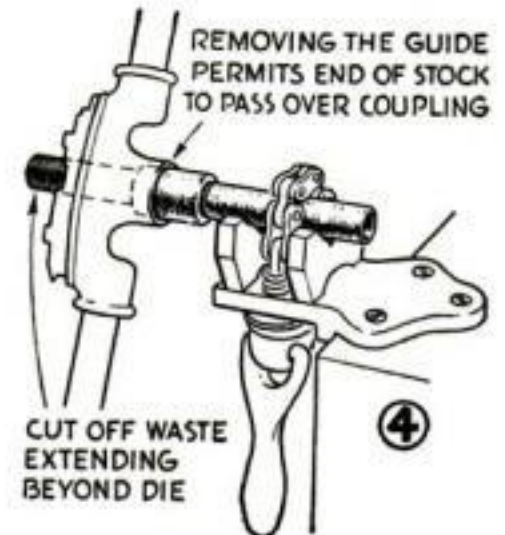
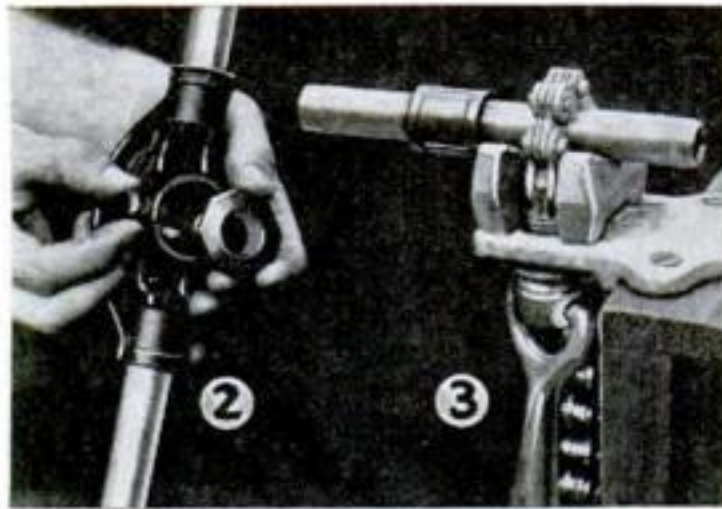
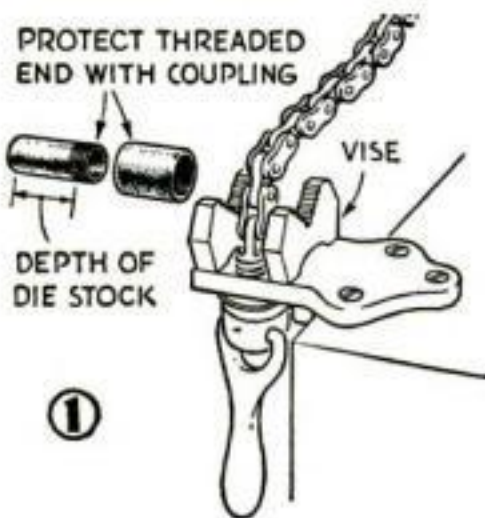


WHEN threads have to be cut on short pipe nipples, the problem of how to hold the work in the vise presents itself. The depth of the pipe diestock and the clamping distance of the vise must be taken into consideration if threads are to be cut on both ends.

A piece of pipe that is just long enough to be gripped in the vise and still pass through the diestock can be threaded on one end in the usual way. Then, to avoid having to grip this end in the vise in order to thread the other end, a coupling should first be screwed on over the threads (Fig. 1).

Still shorter nipples can be handled, providing one end is already threaded, by screwing on another piece of pipe in addition to the coupling (Fig. 3).

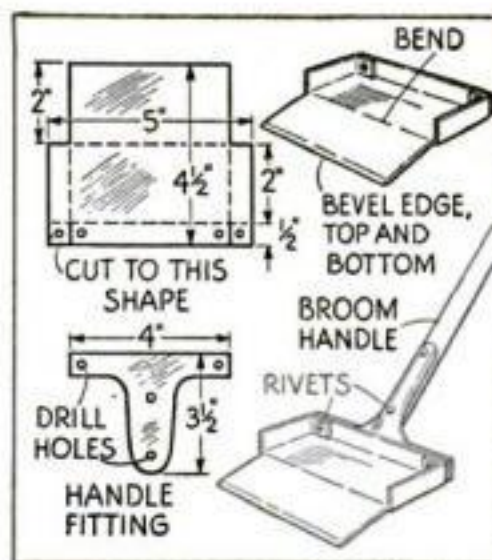
In case the guide of the stock strikes the adjoining coupling before the threads can be cut to the proper length, it can be removed and the cut finished without it (Fig. 2). Extremely short nipples can be made in this way by continuing the thread up the pipe until the desired nipple length is reached, after which the waste can be cut off with a hack saw (Fig. 4). Take care, when cutting without the guide, to avoid twisting the stock.



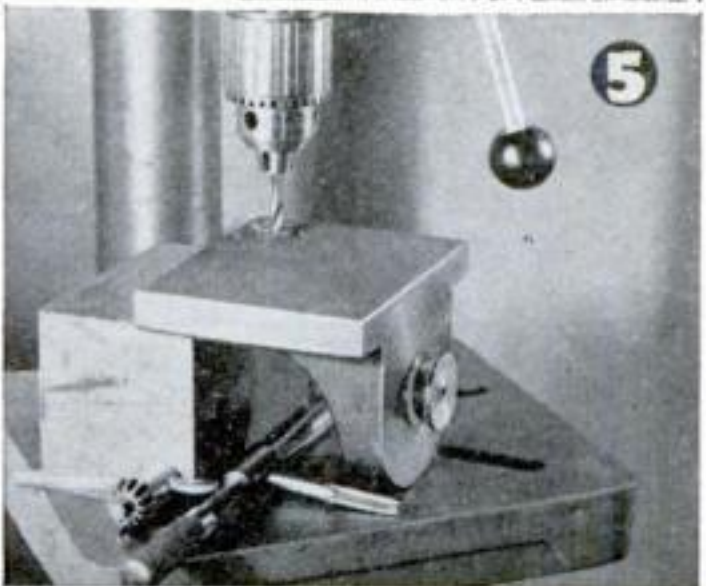
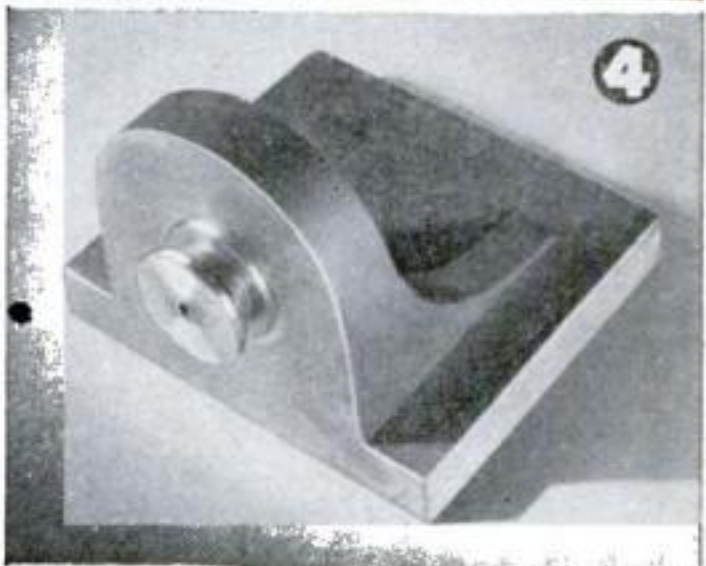
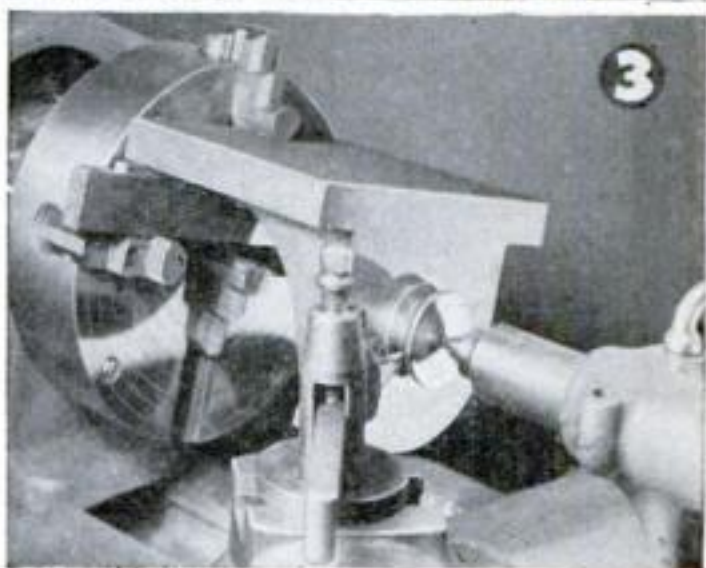
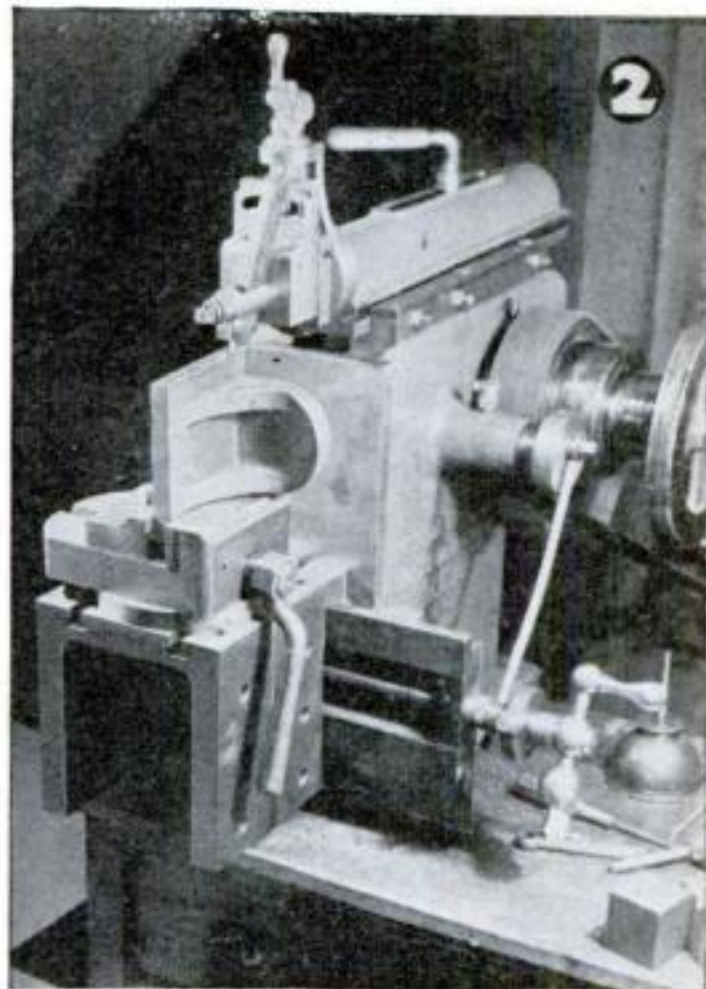
## Scraper Quickly Removes Grease from Garage Floor

HAVE you ever watched a garage mechanic scrape grease from the floor and, after a thin layer had been loosened, patiently try to remove it by sweeping it up with a broom? When this is done, most of the grease merely cakes and stays where it is. With the tool illustrated, however, it can be scraped and collected at the same time, thus solving the otherwise exasperating problem of getting rid of the grease after it has been scraped free.

Any scrap of fairly thin but tough sheet metal will do for making the scraper. Even brass will be satisfactory. The scraper itself and the handle fitting are riveted together, then bolted to an old broomstick. Note that the front section of the scraper is bent downward as to make firm contact with the floor and that the edge is sharpened. An old putty knife can be used to help remove the grease from the scraper into a rubbish can.—EDWARD HAGEN.







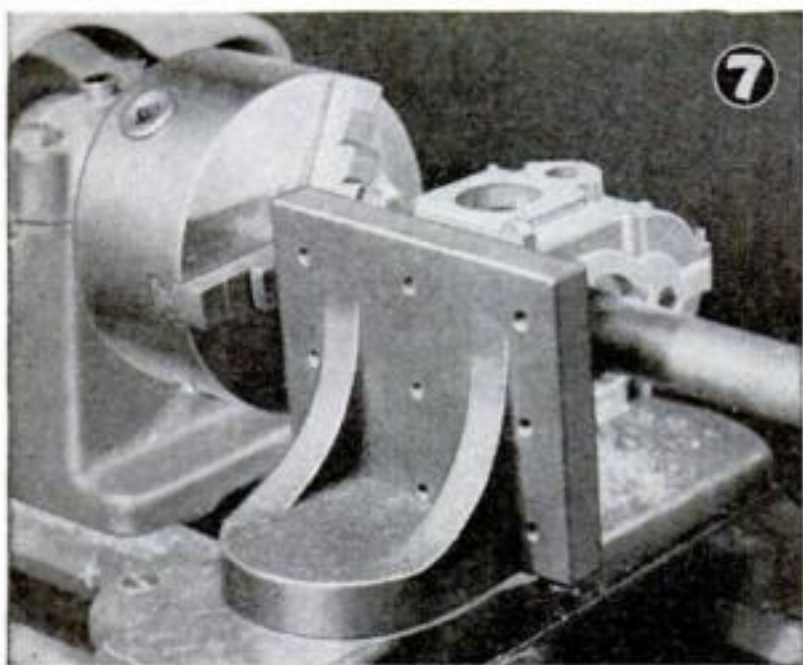
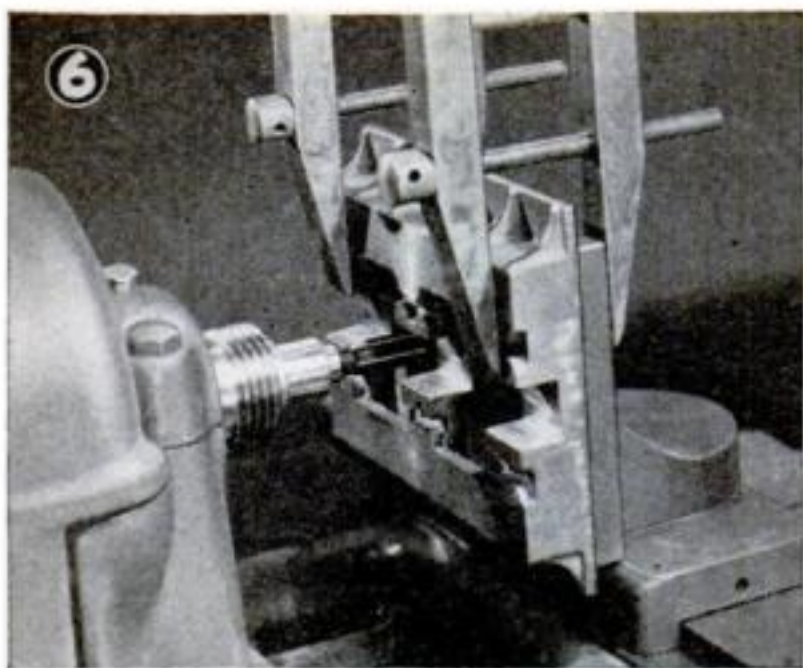
## Cross-Slide Angle Plate AIDS IN BORING AWKWARD WORK

FOR boring small work in the lathe that cannot be held in the chuck, an angle plate of the type illustrated in Fig. 1 will be found a great convenience. It is mounted on the cross slide.

If the angle-plate dimensions given in the drawings are suitable for your lathe and the kind of work you are ordinarily doing, you can build a wooden pattern by adding  $3/32$ " for machining allowance. Have a soft gray-iron casting made from the pattern.

The face and edges of the casting were machined in this particular case on a small shaper as shown in Fig. 2 while the remainder of the work was done on the lathe itself. This was a difficult piece to chuck, but by laying a steel bar across two of the chuck jaws as in Fig. 3, it was firmly held in the four-jaw chuck for machining the base and

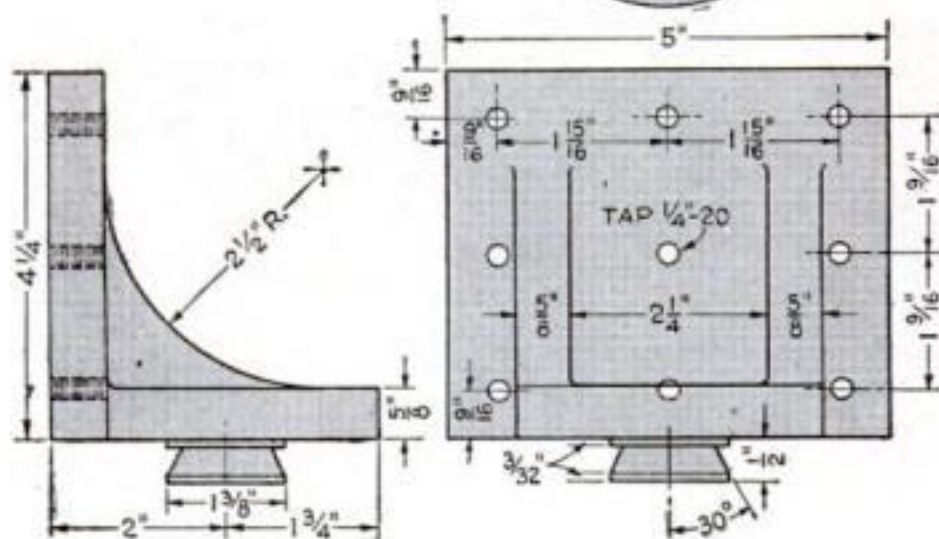
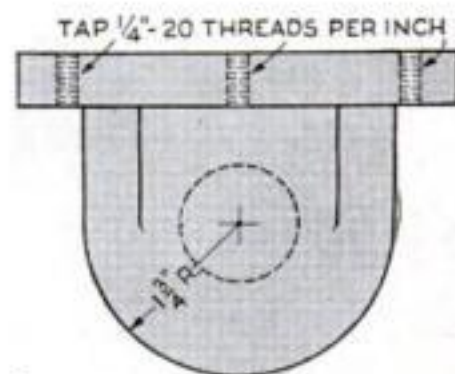




Two uses of the plate: to hold work while a slot is being milled (upper view) and to brace a model engine crankcase for boring

the lug. This lug clamps the angle plate to the cross slide and is a duplicate of the one on the compound rest. When this had been turned to size and the base smoothly finished, the angle plate was checked for accuracy with a toolmaker's square. Figure 4 shows the work done thus far, while in Fig. 5 the nine screw holes are being drilled with a No. 7 drill for tapping  $\frac{1}{4}$ "-20.

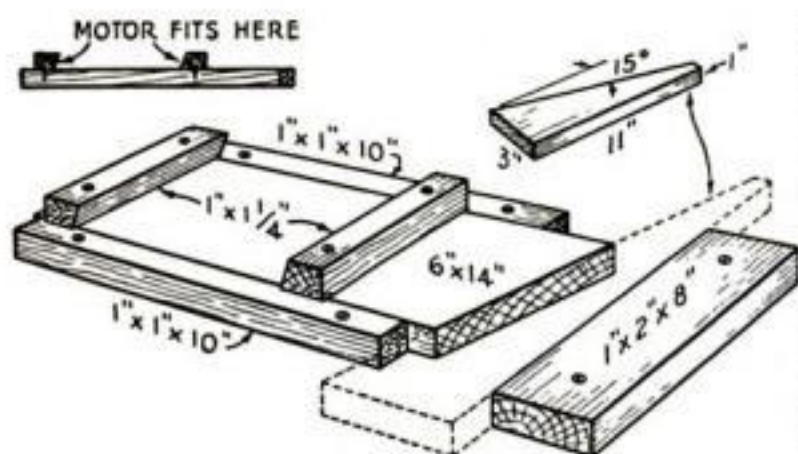
The finished plate is shown in use in Fig. 6. A casting has been fastened to the plate while an end mill in the lathe chuck is cutting a groove. In this way the angle plate serves as a milling attachment. In Fig. 7 the plate supports a model engine crankcase while the holes are bored.



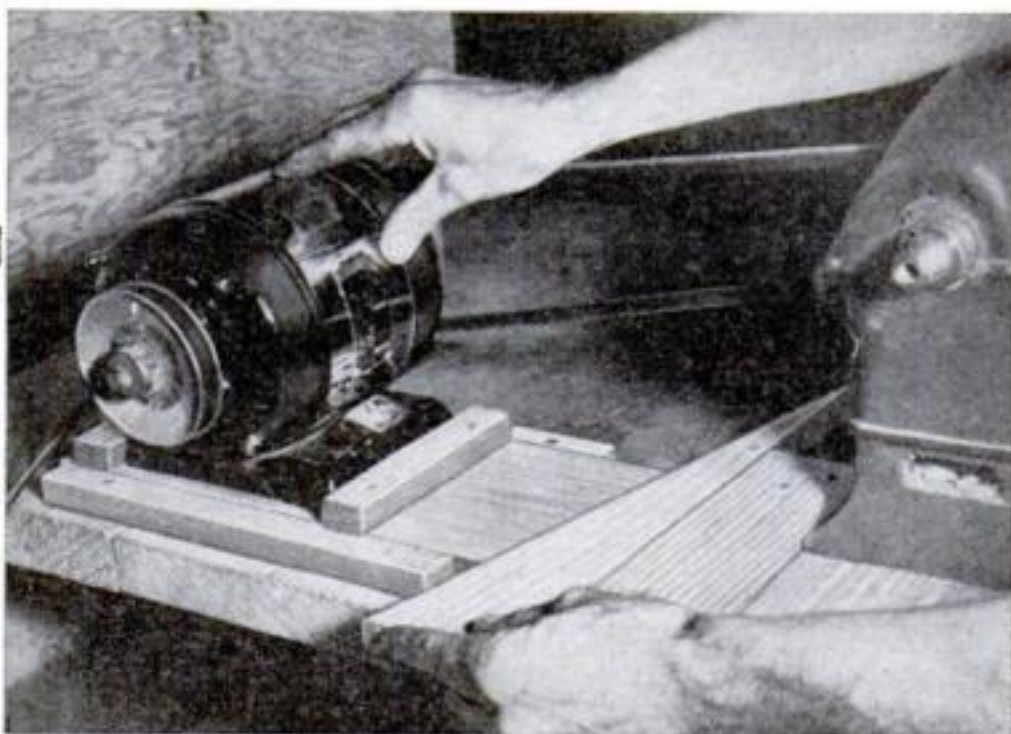
## A Simple Adjustable Mount for a Shop Motor

ONE of the easiest of the many possible ways of mounting an electric motor to run home-workshop machines is that shown in the illustrations below. At a touch of the finger, the slide may be adjusted with the wedge to suit different-sized pulleys. It is

an equally simple matter to move the motor from side to side for aligning the belt. While the motor is not bolted down, it is held securely, and it may be lifted out whenever necessary for use with other machines in the shop.—LESTER STRATTON.



The base of the motor fits between two cleats on the sliding board. The bevel on the rear cleat is sufficient to hold down the motor while in use



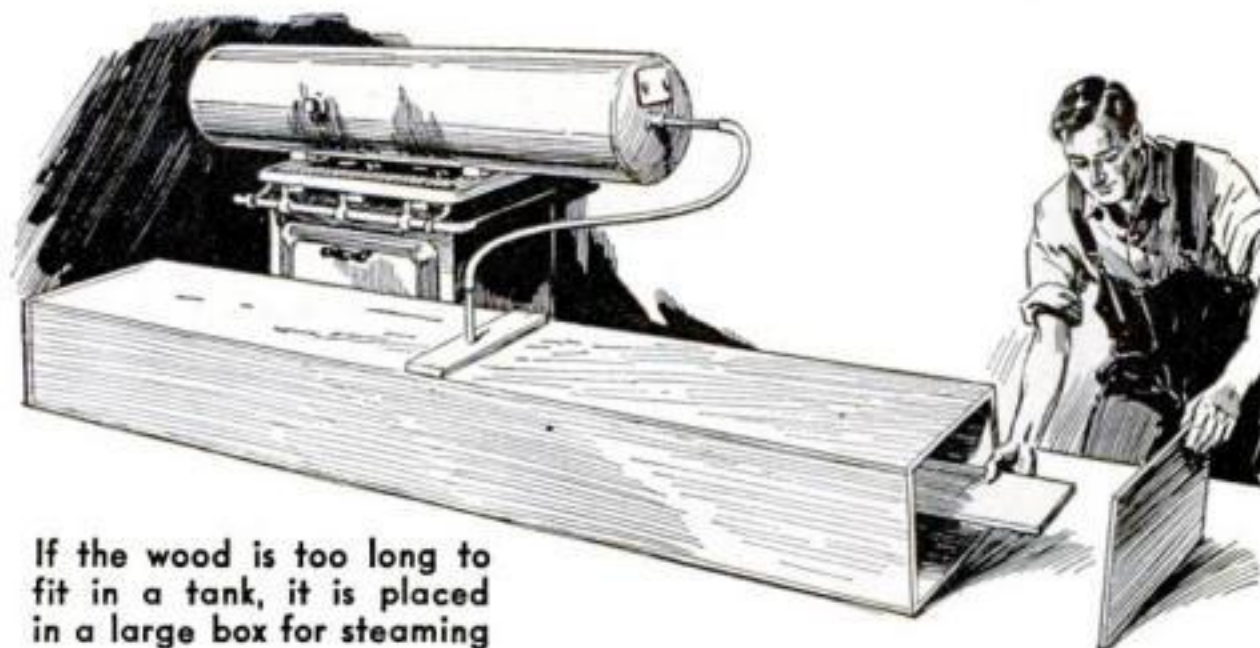


# Discarded Hot-Water Tank Serves for Steaming Wood

FOR steaming wood preparatory to bending it, the arrangement illustrated has proved satisfactory in boat repair work during many years past. All that is needed is a discarded hot-water tank, some pipe fittings, lumber, a garden hose, and a source of heat—in this case an old gas range.

Have a hole cut in one end of the tank as shown and make a suitable cover. This may be a piece of 12-gauge sheet metal large enough to overlap about  $\frac{1}{2}$ " on all sides of the opening. Drill and tap two holes in the tank so the cover can be bolted in place with a rubber gasket cut from an old inner tube. The other outlets in the tank may be plugged with metal plugs or ordinary wooden plugs.

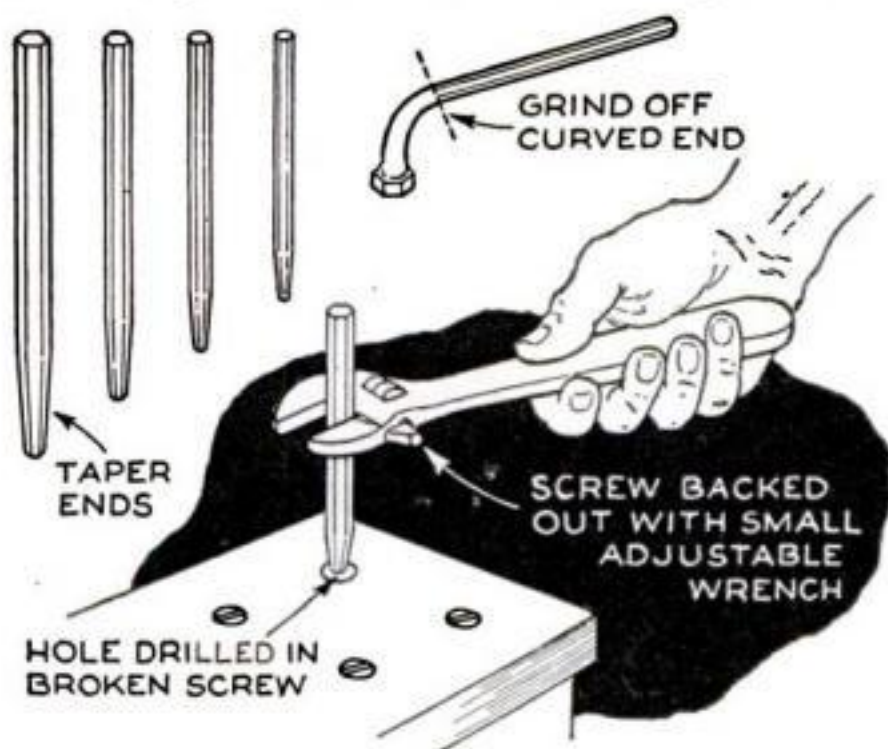
If the wood to be steamed is short enough to go into the tank, simply fill the tank half full of water and let the wood float in the water. Fasten the cover loosely enough so that some of the steam can escape. Do not under any circumstances let the pressure



If the wood is too long to fit in a tank, it is placed in a large box for steaming

build up so as to run any risk of an explosion. Leave the wood to be boiled and steamed for at least two hours; then fish it out and bend it quickly before it can cool.

When the wood is too long for the tank, build a wooden steam box as illustrated. The wood is inserted from one end and a cover is nailed on. Connect the box with the hot-water tank by means of a rubber garden hose. This is done by inserting a  $\frac{1}{2}$ " reducer in place of one of the plugs in the tank, and fastening a length of pipe to it; then thrust another length of pipe into a hole in the center of the steam box.—MATHEW DEBEVIC.



## Powerful Screw Extractors

A SET of screw extractors that are more durable than the ordinary spiral type can be made from the five smallest sizes of safety set-screw wrenches. First, grind off the curved end; then carefully taper one end to about two thirds its full size, being careful to preserve the hexagonal shape. To use, a hole is drilled in the broken screw that will allow an extractor to be driven in with a hammer. A small adjustable wrench is applied to back out the screw.

## Small Irregular-Shaped Parts Polished with Manicure Pads

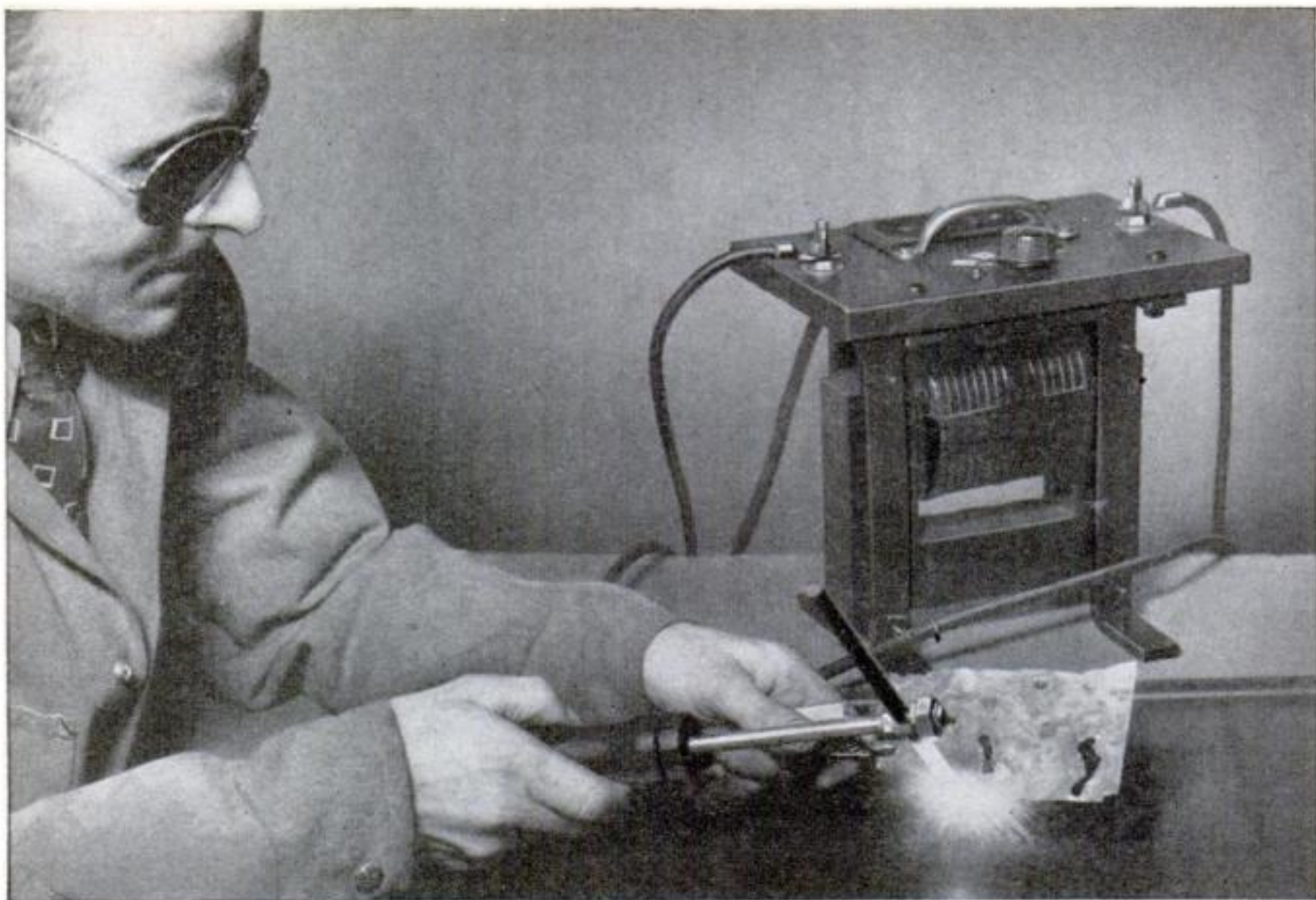
POLISHING pads or tips of the type shown, made for use with a manicure machine, are excellent for polishing small, irregular-shaped articles. The tips consist of flat, flared, or rounded felt disks cemented to a metal arbor that can be fastened in a drill press, hand carver, or flexible shaft. The felt may be charged with any abrasive or polishing powder.

Besides being used for routine polishing, the tips can be employed to give a figured effect on polished metal surfaces, similar to the decorative pattern often seen inside the case of a watch.

These pads can often be obtained from a local beauty shop for little or nothing.







When used at full power, the transformer produces an arc that will burn holes through sheet metal

# Electric-Arc Soldering

Part II

By HAROLD P. STRAND

**V**ERY little work is needed to finish our electric-arc soldering and lead-burning outfit. Place the primary-secondary coil on the open end of the core and replace the laminations as in Fig. 8. Note that the heavy secondary ends are at the top (right side in photo) and the primary taps are at the sides of the core. No taps are made at the bottom, which might interfere with replacing the core pieces. Thin strips of fiber are pressed in between the core and the coil at two sides to aid in squeezing the laminations together. Bands of tape passed around the lower leg of the core serve for the same purpose there, so that loose laminations cannot vibrate.

With all pieces in place, attach the other two side irons and gently tap all laminations so the joints will be tightly driven together. In Fig. 9 the transformer has been assembled that far and in addition two 125-ampere copper lugs have been soldered to

the ends of the secondary winding. Holes in the lugs are reamed to clear  $\frac{3}{8}$ " bolts.

The top board is made of  $\frac{3}{4}$ " plywood and given two coats of flat black paint. Two 2" by  $\frac{3}{8}$ " brass machine screws with washers, nuts, and wing nuts are used for the terminal posts.

The four-point switch is next made as shown in the drawings, and holes are bored for this and the single-pole switch in the top board.

After the connections have been made, the unit appears as in Fig. 10. For the supply cord, No. 16 heavy-duty extension cord is used, and No. 4 motor lead wire will be found serviceable for the electrode wires. This has a light but durable covering and is very flexible. It can be obtained in almost any motor rewinding shop.

The carbon holder can be made in a number of ways. Two methods are suggested in the drawings. The writer used a heavy solderless wire connector in which a hole was drilled to receive the threaded end of a  $\frac{7}{16}$ " brass rod. A soldering-iron handle was drilled through to fit snugly on the rod, and the 90-ampere lug of the electrode wire



was held tightly between two brass nuts.

A little filing with a round file was necessary in the connector to make it fit the 9-mm. carbon recommended for general use. Larger or smaller carbons can be used as required. The smaller ones are clamped in the same connector, and a wire connector of the next larger size is prepared to fit on the end of the rod for heavier work.

The sliding-sleeve type of holder is also serviceable and, in fact, is preferred by some mechanics.

To use the transformer for soldering, place the switch on step 1 or 2 and turn the single-pole switch "on." Clamp the grounding clamp to the work or to a piece of metal in contact with it. The end of the carbon

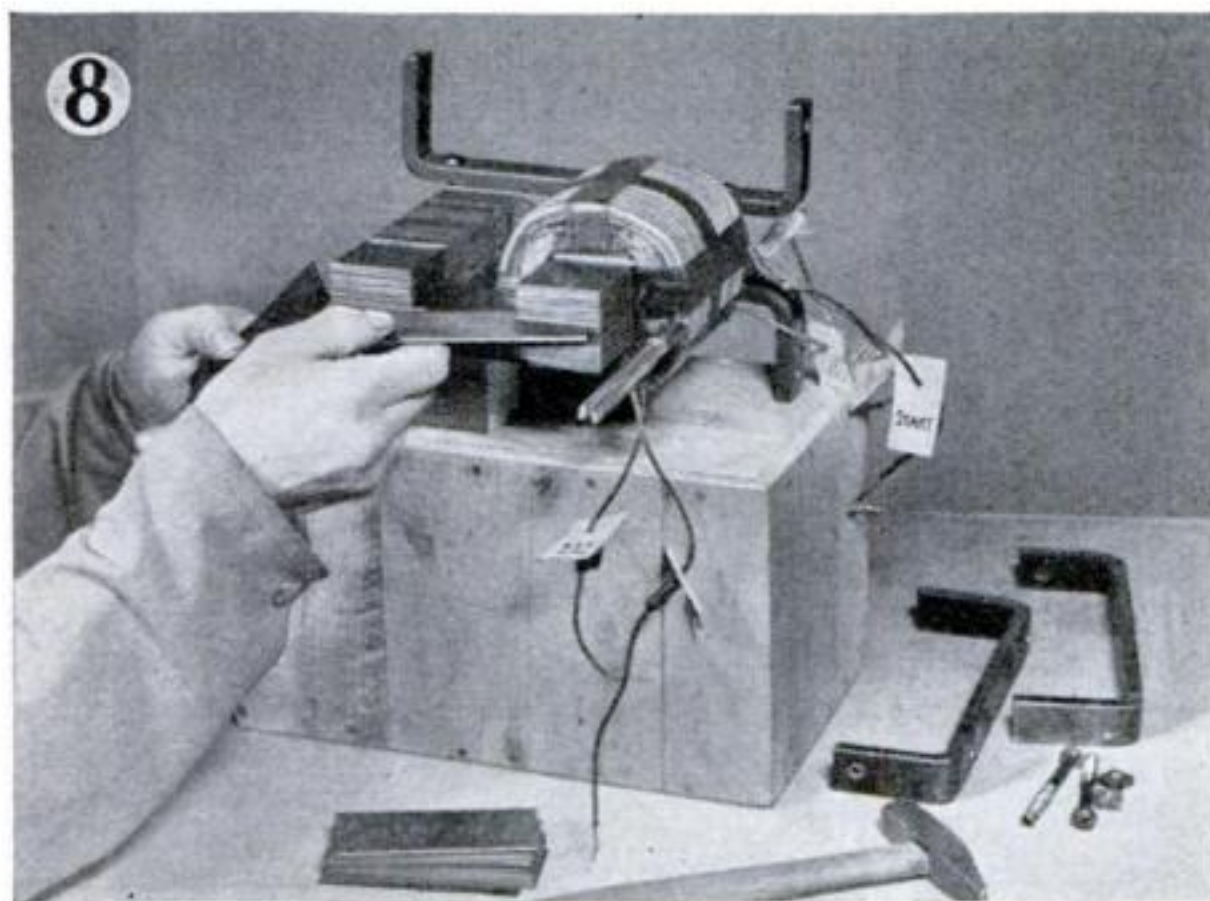
can now be touched to the work and it will quickly heat to a red temperature. In a few seconds this will increase to a white heat, and if solder is applied to the cleaned and fluxed spot, it will flow in perfectly. The carbon is moved along, followed by the solder. In spite of the tendency of a large mass of metal to draw away the heat, continuous soldering can be accomplished.

For heavier work, step 3 of the switch may be used. In some work the carbon can be slightly drawn away to form an arc. This method will be especially useful on step 4 when cutting or burning sheet metal. It produces a great heat—approximately 4,000 deg.—at which steel drips almost like a cake of melting ice.

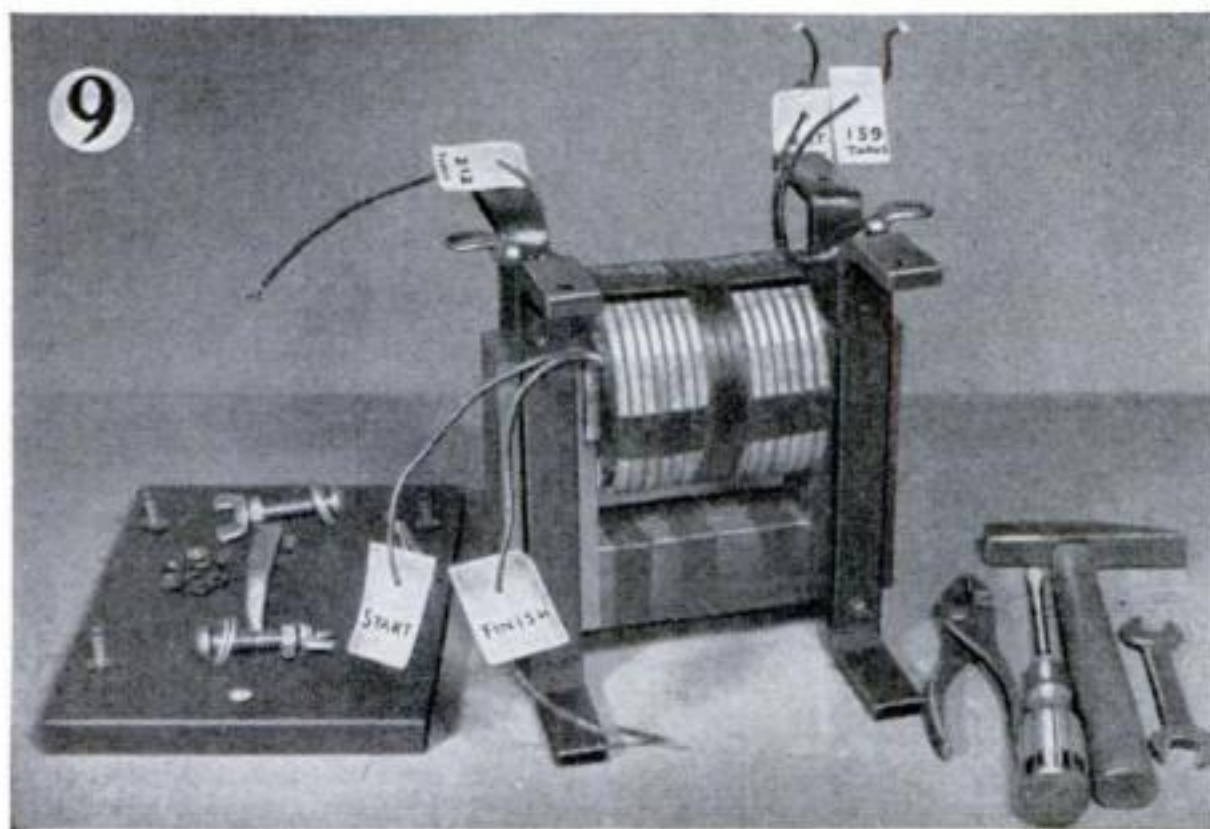
The input and output of this transformer will vary with the length and diameter of the carbon used, as well as with the distance between the spot touched on the work from the grounding clamp. In addition, unlike ordinary metal conductors, which increase in resistance and consequently provide lower conductivity with an increase in temperature, carbon is the reverse. As the temperature increases, it lowers in resistance and more current will flow. This means that the longer it is held to the work and as the color changes from red to white heat, an increase in current both in the primary and secondary will follow until the maximum value is reached.

Tested with a piece of 9-mm. carbon projecting 3" from the holder and held about a half minute to the work on each of the four steps, the following meter readings were obtained (maximum):

Step 1—primary amperage, 1.7; secondary voltage, 5; secondary amperage, 40. Step 2—primary amperage, 2.8; secondary voltage, 5.8; secondary amperage, 70. Step 3—primary amperage, 5; secondary voltage, 7.6; secondary am-



The taped coil is placed on the open end of the core and the laminations replaced. Weave them in as they were originally arranged



Next, the remaining side irons are clamped on. Then the terminal board is cut out for the switches and bolted to the side-iron tops



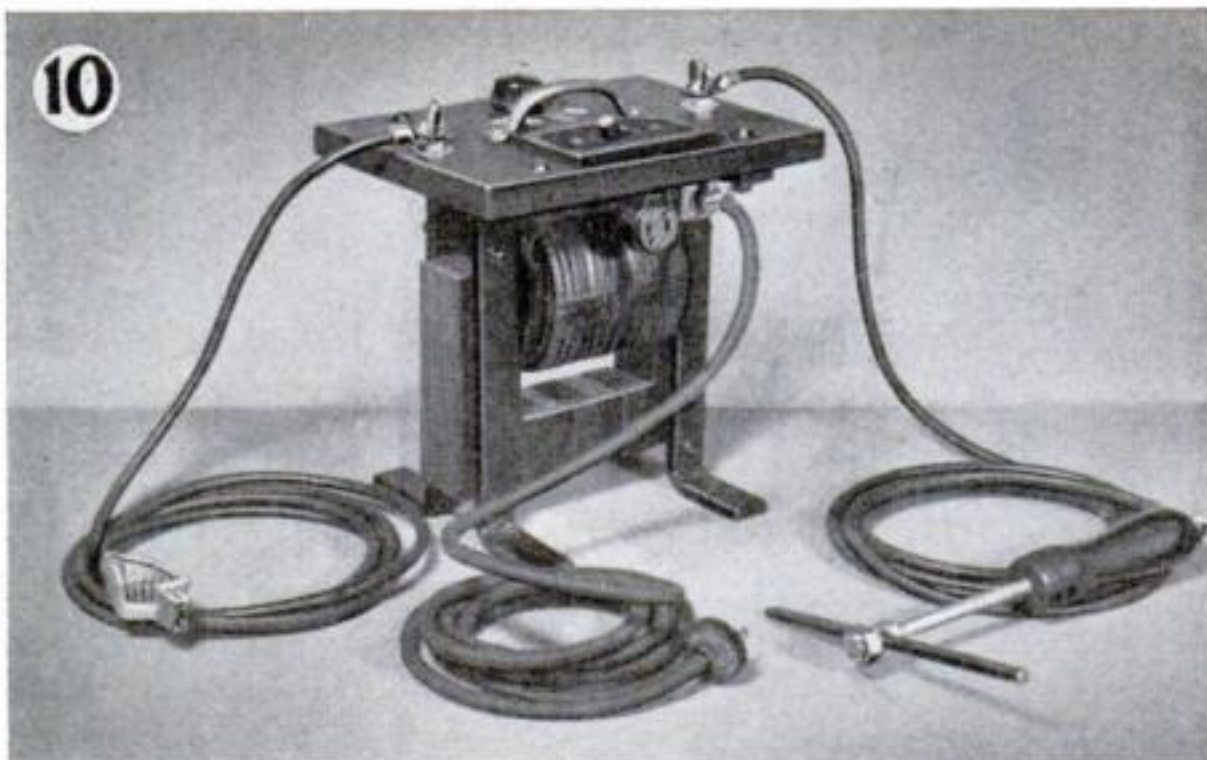
perage, 90. Step 4—primary amperage, 11; secondary voltage, 9; secondary amperage, 120.

With no load, the secondary voltages were respectively 5.1, 6.1, 8.2, and 10.1, so it can be seen that a reasonable and permissible drop in voltage takes place at full load. This gives the transformer a minimum rating of 200 watts and a possible maximum of 1,080 watts. It is a good plan, however, to use no more current than is actually necessary for the particular work.

Use the fourth step of the switch for short periods only, because it somewhat exceeds the capacity of the iron core for continuous use. Nevertheless, the core will stand overloading for intermittent service.

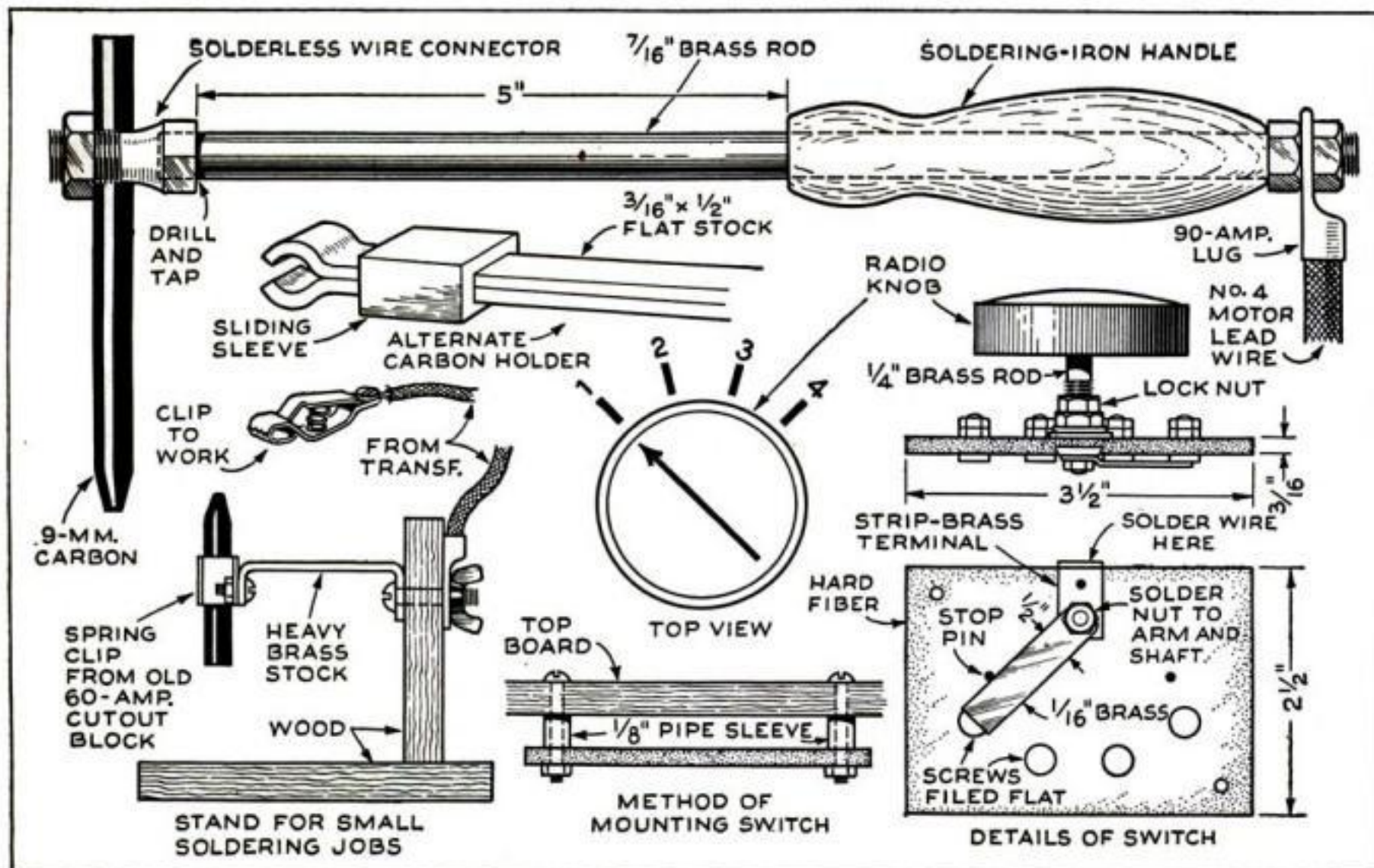
Most soldering can be done on the first two steps, with the third reserved for heavy metal. Step 4 will be found useful for burning and cutting light metal and making edge welds in sheet metal. With practice, a small welding or brazing rod can be fed into the molten metal to build up where required. Lead burning can be done on steps 3 and 4.

In using this transformer, guard the eyes from the intense light when the carbon is



The toggle switch in front turns the transformer on and off; the four-point rotary switch provides four secondary voltages to suit the work

white hot. Goggles of the type used in arc welding are recommended, but a pair of very dark sun glasses will answer if at hand. Leather gloves can also be worn for protection from sparks or bits of molten metal. This is more necessary on steps 3 and 4 of the control switch, where a very high wattage is delivered to the carbon. Because of the comparatively low voltage in the secondary windings of the transformer, there will be no danger from shock. Never attempt to use a welding or brazing rod in the carbon holder. If carefully built, this transformer should give long service.



Carbon holders, switch, and other details. The carbon can be clamped in a stand or held in a handle

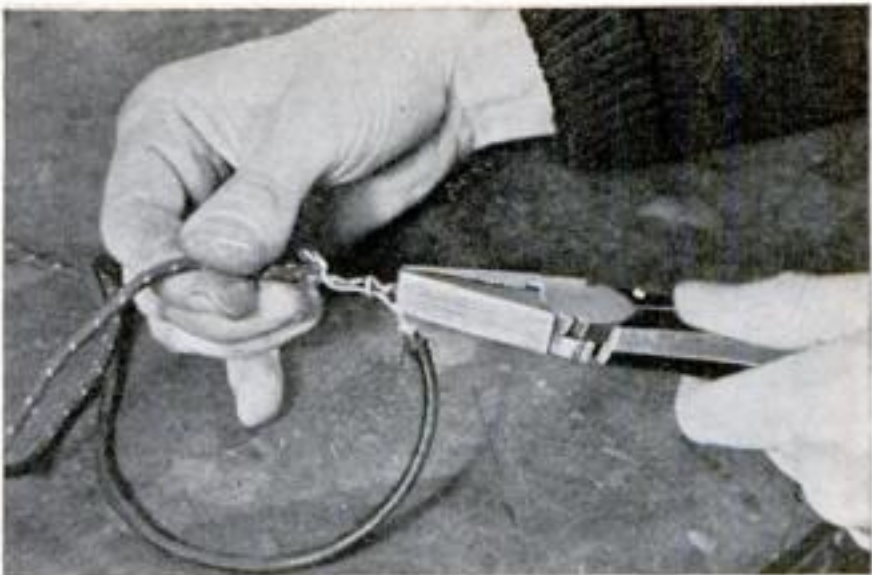


# Big Rubber Band Keeps Plug from Pulling Out of Socket

WHEN an electric appliance or tool is plugged into an extension cord, the plug has an annoying tendency to pull from the socket on the slightest excuse. Sometimes



the parts are wired together, but this is not entirely safe. A better method is to use a heavy rubber band attached as shown at the left so that the plug will hold securely, yet may be quickly removed without difficulty. The rubber band can then be placed around the cord, available for future use.

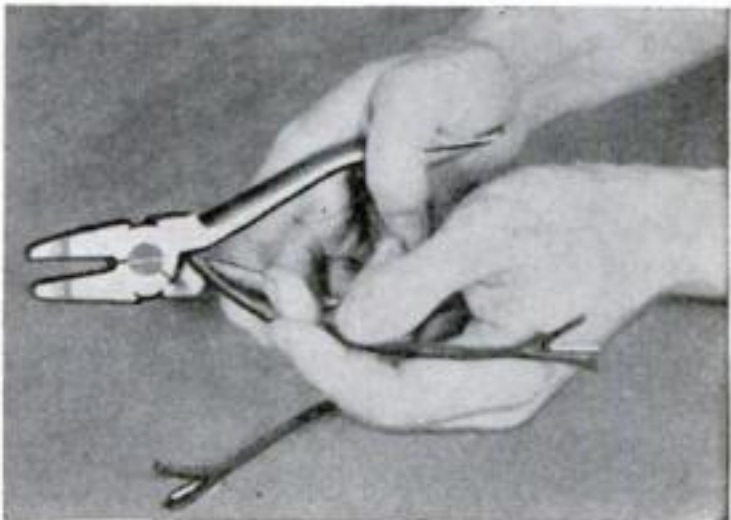


# Flexible Lamp Cords Joined by Using a Fisherman's Knot

A SECURE way to connect two pieces of flexible lamp cord end to end is to remove the insulation for a somewhat greater distance than usual and tie the wires together with a fisherman's knot, as shown, rather than use an ordinary twisted splice. The joint should be soldered and wrapped with rubber and friction tapes in the usual way.

# Handle Side of Pliers Used for Stripping Insulation

INSULATION is easily removed from the end of a wire with ordinary side-cutting pliers used as shown at the right. Insert the wire between the handles just back of the pivot pin. A slight pressure on the handles will then mash the insulation so that it either comes off in the process or may be pulled off with little or no effort.—R. B. S.



## CAPACITY OF COPPER BUS BAR [ELECTRICAL]

When building or connecting up apparatus in which flat strips of copper bus bar are used to carry current, one should know the carrying capacity of this material, because it cannot be found from a table of carrying capacities of round copper wires. Carrying capacity is figured at 1,000 amperes per square inch.

Thickness	Width	Area in square inches	Capacity (amperes)
1/16	1/2	.0313	30
1/16	3/4	.0469	50
1/16	1	.0625	60
1/16	1 1/2	.0938	90
1/8	1/2	.0625	75
1/8	3/4	.0938	90
1/8	1	.125	125
1/8	1 1/2	.1875	200
1/8	2	.25	250
1/4	3/4	.1875	185
1/4	1	.25	250
1/4	1 1/4	.3125	315
1/4	1 1/2	.375	375
1/4	1 3/4	.4375	435
1/4	2	.5	500

POPULAR SCIENCE MONTHLY SHOP DATA FILE





## Reel for Xmas-Tree Lights

ONE chore that often mars the Christmas spirit is unraveling the old strings of lights before decorating the tree. This can be avoided by making a reel from  $\frac{1}{4}$ " plywood as shown. It provides slots for winding three sets of lamps.—F. H.

## Testing a Small Cartridge Fuse

FOR testing nonindicating cartridge fuses, one maintenance man uses a flash light with the end cap removed and the switch in the "on" position. The flash light and a good fuse or short piece of metal are held as shown. The fuse to be checked is then pressed against the flash-light battery and the good fuse so that the electrical circuit is completed. If the bulb flashes on, it is clear that the doubtful fuse is all right; if the bulb does not light, the fuse is blown and is discarded.—MORRIS KATZ.

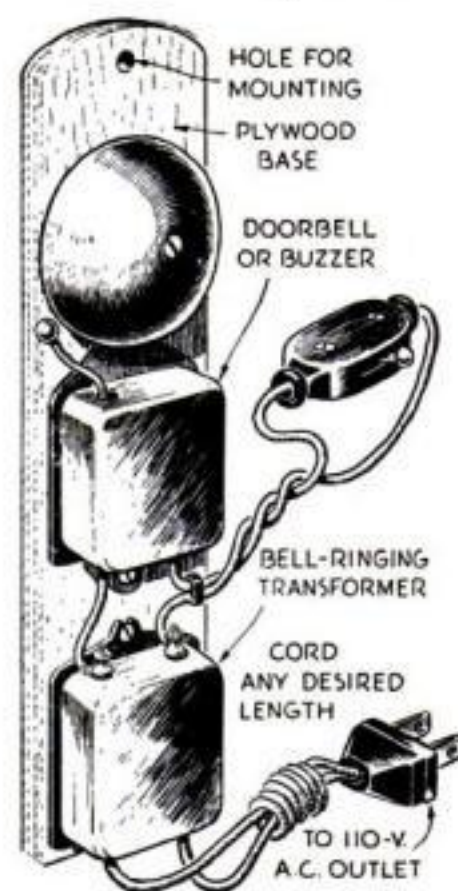


## Using Flash-Light Cells Longer

WHEN a two-cell flash light of the pre-focused type is used a great deal, the batteries and bulb can be made to give longer service by substituting a bulb intended for use in a three-cell light of the same type. The lamp will still give ample light.—R. A. C.

## Invalid Can Ring for Help with Portable Call Signal

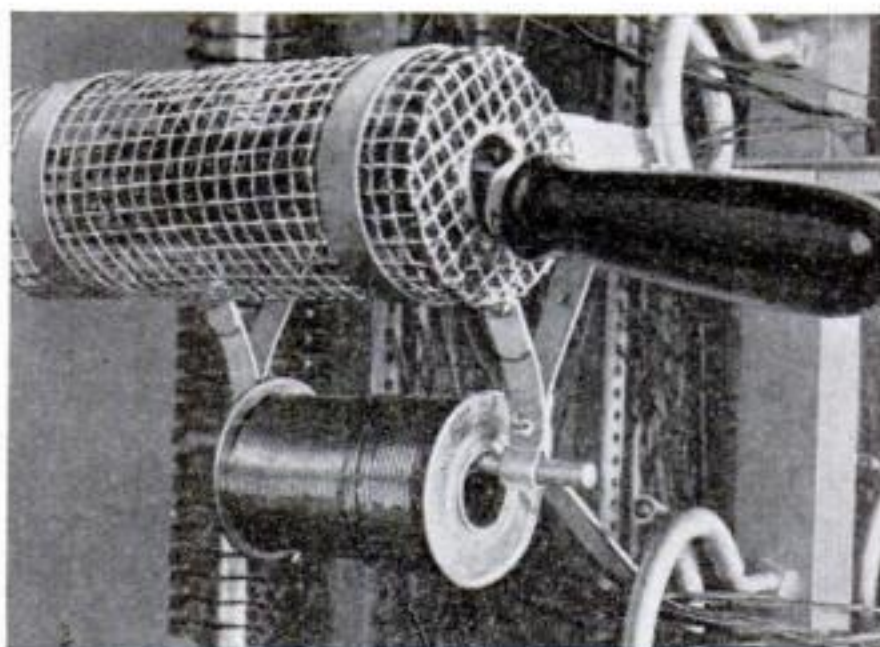
TO ENABLE an invalid to attract the attention of others in the home, a portable electric signal is easily made as shown in the accompanying diagram. A push button may be substituted for the feed-through switch, a buzzer for the bell, and dry cells for the transformer, if preferred. The longer the switch cord, the farther the bell may be placed from the sick person.



Other uses for the portable call signal will suggest themselves. For example, the unit could be taken into a darkroom by the photography enthusiast who expects to be called but does not want the door opened unexpectedly, or who has his darkroom located in the basement.—WILLIAM E. HAYES.

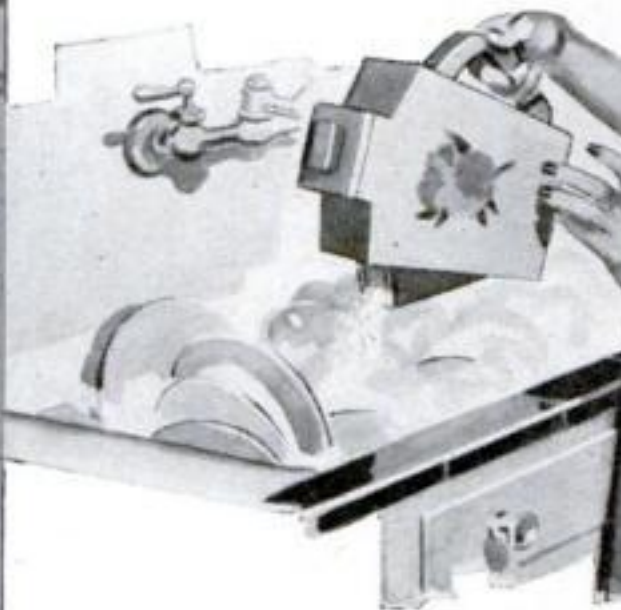
## Holder Made of Wire Mesh Keeps Soldering Iron Handy

ELECTRICIANS and others who use an electric soldering iron constantly will find this holder useful. It is easily constructed from square-mesh wire screen woven together with pliers at the corners and held in position with clamps. The holder for a spool of rosin-core solder is an additional convenience. This device may be attached to a workbench or made portable by mounting it on a suitable base.—RAY BLAIN.





*Working Time:*  
**ONE EVENING**



CRAFTSMAN'S TIME . . . 2 hours for either project  
BEGINNER'S TIME . . . 3 hours for either project

# Soap Dispensers FOR KITCHEN AND LAUNDRY

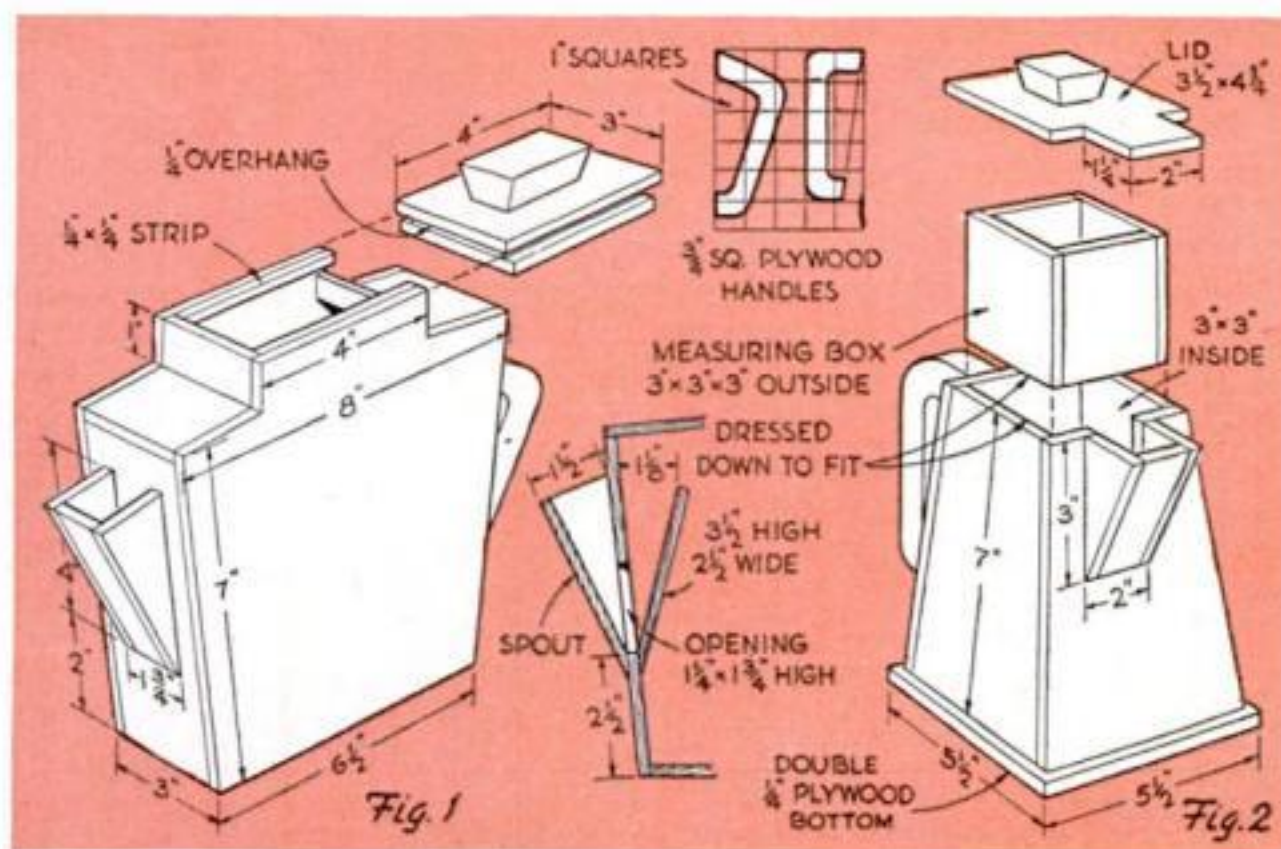
**B**ECAUSE of the design of its spout, the bead-soap dispenser shown in Fig. 1 below limits the amount of soap one can pour to a heaping tablespoonful. This automatic feature is especially desirable for washing dishes, and it eliminates waste.

The container is made of  $\frac{1}{4}$ " plywood, and the sliding lid is built up of three pieces of the same material, the center one being narrower so as to form a groove to slide over the strips nailed to the inside of the opening.

In Fig. 2 is shown a dispenser for soap in either flake or bead form. A measuring box attached to the lid holds one cupful. This is suitable for laundry use, as well as for the kitchen.

The spouts and handles should be assembled before gluing and nailing the boxes together.

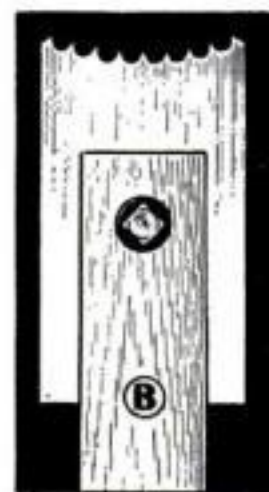
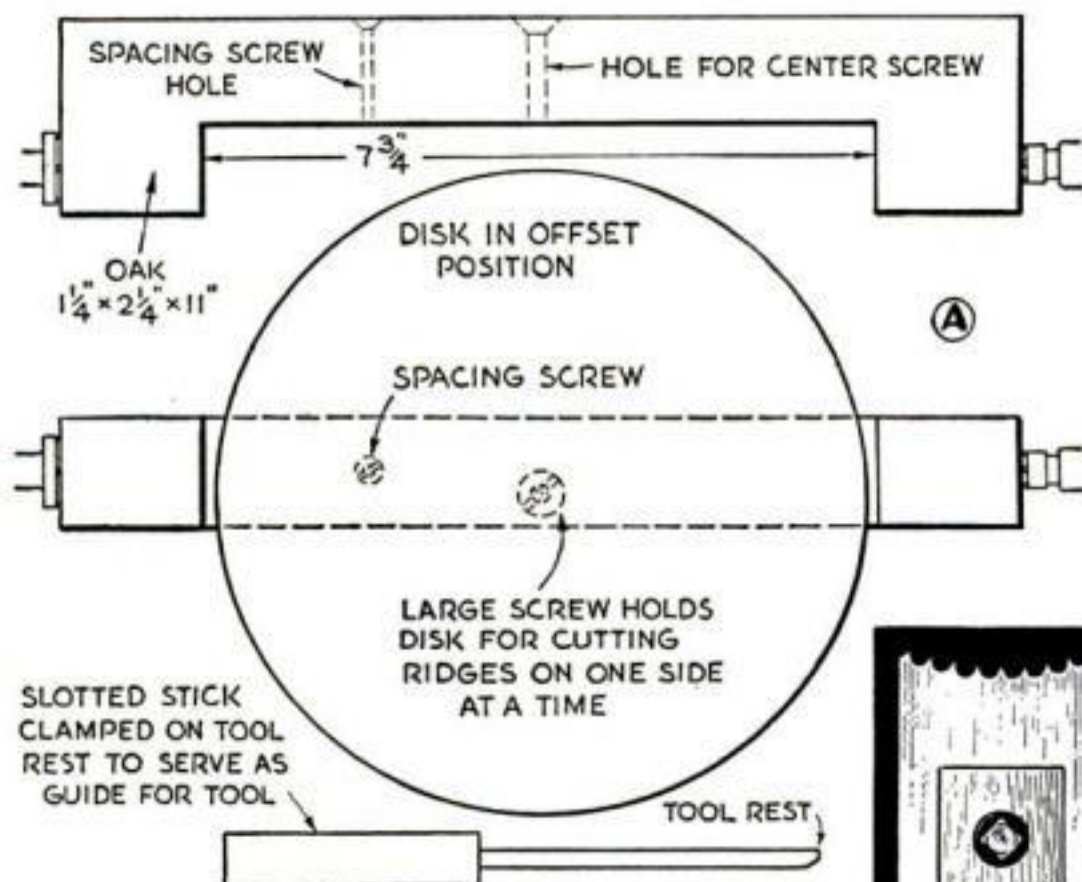
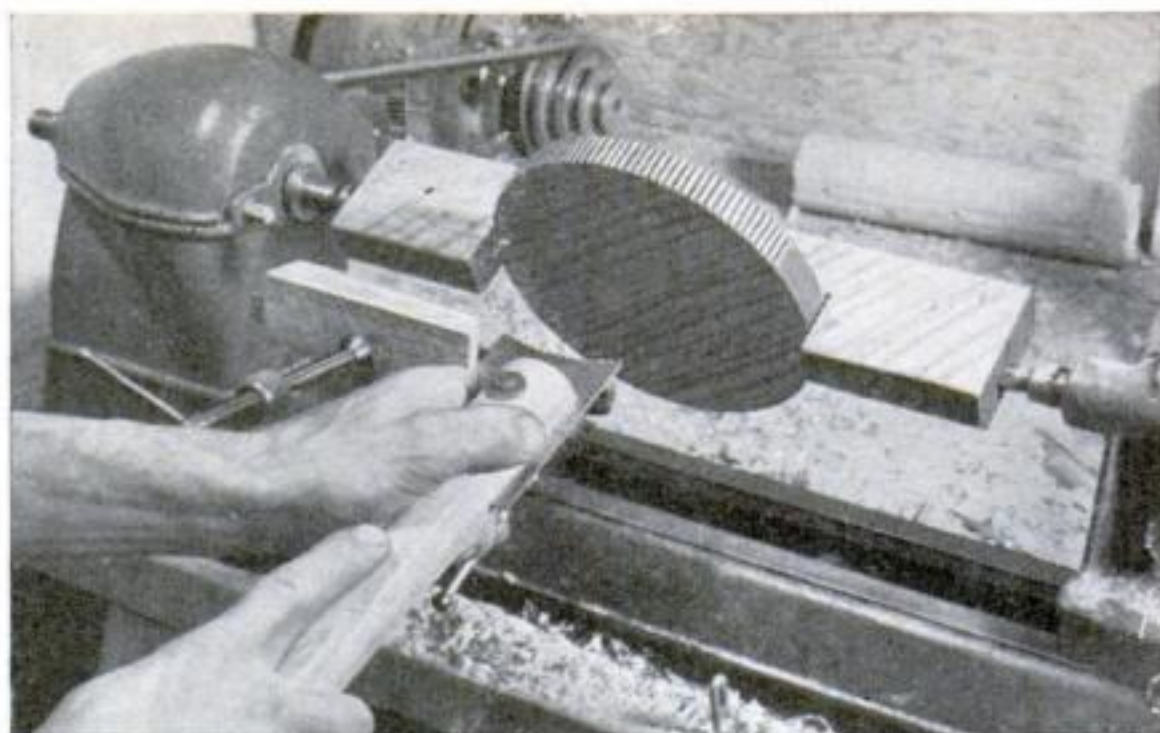
Paint the two boxes ivory, and color the spouts, handles, and lid knobs to match the kitchen trim. A flower design transfer or other decorations on the sides will improve the appearance greatly.—FRANK HEGEMEYER.



The dispenser in Fig. 1 is for bead soap; in Fig. 2, for beads or flakes



# Spiral Inlaying



**M**ODERN decorative effects in wood turning can be obtained by using machine set-ups of the type illustrated. Thin bands can be inlaid spirally around turned columns, standards, or legs; and flat faceplate turnings, such as lamp bases, can be ornamented with vertical fluting on the edges. These methods were used in making the inlaid lamp illustrated, but it is not necessary to copy this particular lamp since the same ideas can be applied to many decorative projects.

The base of the lamp consists, in this instance, of two 7" disks cut from  $\frac{3}{4}$ " walnut stock. Turn the edge of the lower base section to  $\frac{1}{2}$ " thickness, and  $\frac{5}{16}$ " in from the edge turn a ring  $\frac{1}{8}$ " high and  $\frac{3}{8}$ " wide to serve as a circular tongue to fit into a groove in the upper base member. Inside this ring turn down the stock  $\frac{3}{16}$ " more to allow space for the connecting wire to the canopy switch.

Slightly round the edges of the top section

of the base, remove from the lathe, and place in a jig made as shown at A in the drawings. This is used in the lathe for cutting the vertical ridges as shown above. A special tool is required for this purpose. It is made as indicated at B in the drawings by filing grooves approximately  $\frac{1}{8}$ " deep in a scraper blade and fastening the blade in a wooden handle.

After the ridges are cut, mount this section of the base on a faceplate and cut a groove to take the projecting ring on the bottom section. Now reverse the work on the faceplate and taper the top side down to  $\frac{1}{2}$ " in thickness at the edge, leaving it the full  $\frac{3}{4}$ " thickness in the center. Turn a 2" hole in the center to take the standard. Fit in a canopy switch as at C. Now drill a  $\frac{1}{4}$ " hole in the side of the bottom section for the wire, and connect the wire to the switch.

For the standard, turn a 3" column from walnut 6" long. To cut the grooves for the



inlays, a jig is rigged up on a bench saw as shown. A thin, smooth-cutting saw blade is best. The blade is lowered to make a cut  $\frac{1}{8}$ " deep. Place the jig on the saw table at a 40-deg. angle, start the cut carefully, and slide and turn the column at the same time so the saw cut is clean and uniform. The groove slides over the pin, which serves as a guide. Three cuts are made equally distant apart.

Before making the cuts in the opposite direction, the inlays are inserted. The inlays are turned from a 7" maple disk. They must be of a size to fit in the grooves snugly, and slightly tapered to insure a tight fit. Half of a ring is necessary for each cut.

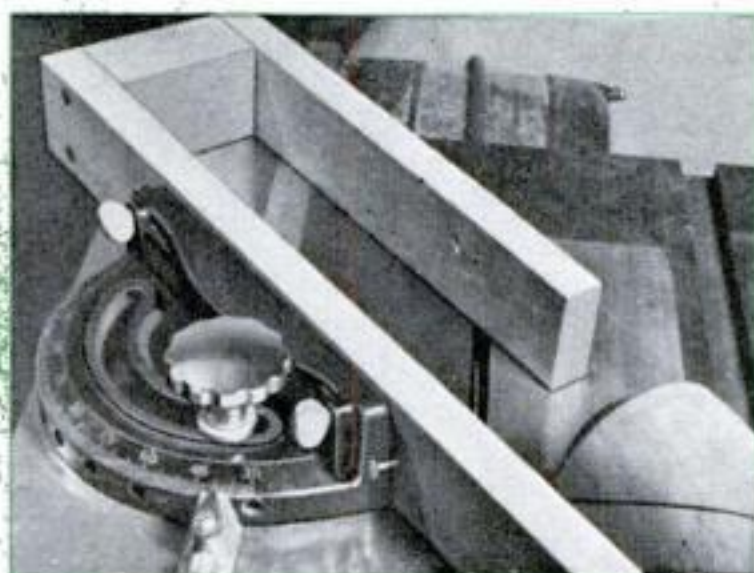
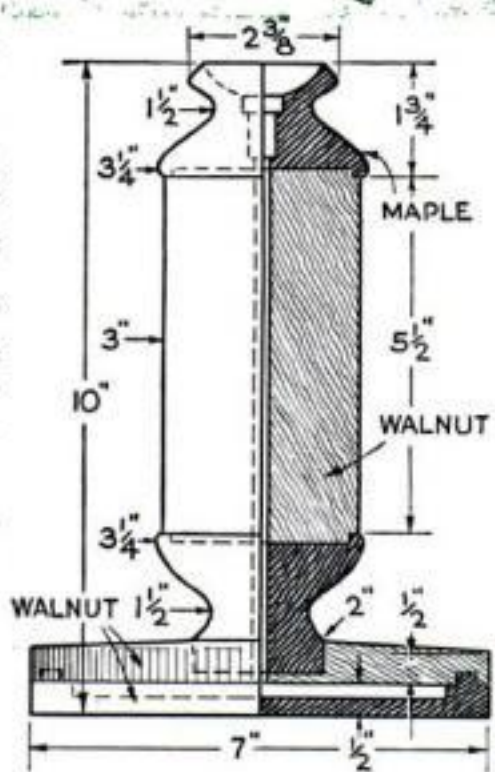
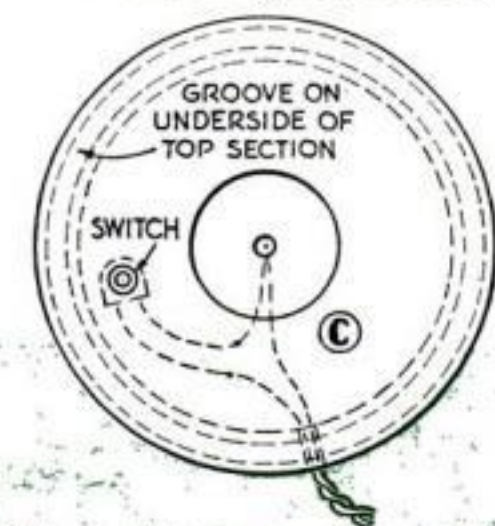
A vise might serve for pressing in these inlays, but the lathe was used in this instance, as illustrated at the bottom of the page. Glue the inlays into place and sand off smoothly.

Reverse the jig on the saw to cut the corresponding grooves in the opposite direction. Be careful to start the cuts so they match at the top of the column. Insert the inlays as before.

Place the column in the lathe and cut off to measure  $5\frac{3}{4}$ " long, which should make the inlays come together, as illustrated, at top and bottom. On each end of the column, turn a projection  $\frac{1}{8}$ " in from the edge and  $\frac{1}{8}$ " high. These fit into recesses cut into the top and bottom maple sections.

Drill the column parts through the center for the wire. Then assemble the parts of the base and the column with glue. The lamp socket fits down into the top maple section and is attached by means of a short nipple that screws into the standard.

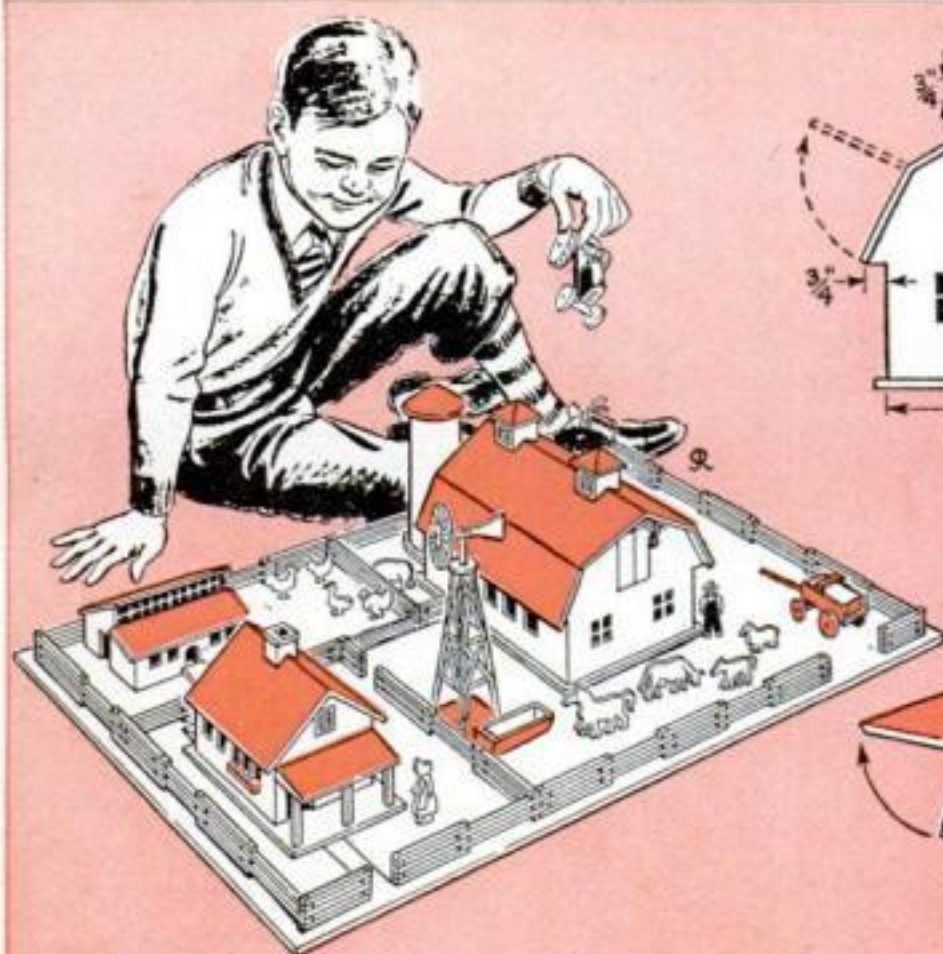
Finish all of the parts before removing them from the lathe. Simply apply shellac and, before it dries, start the lathe and hold against the work a cloth on which some shellac, a drop of oil, and a little alcohol have been placed.—B. N.



A jig holds the column for sawing the grooves. Below, cutting inlay strips and inserting them





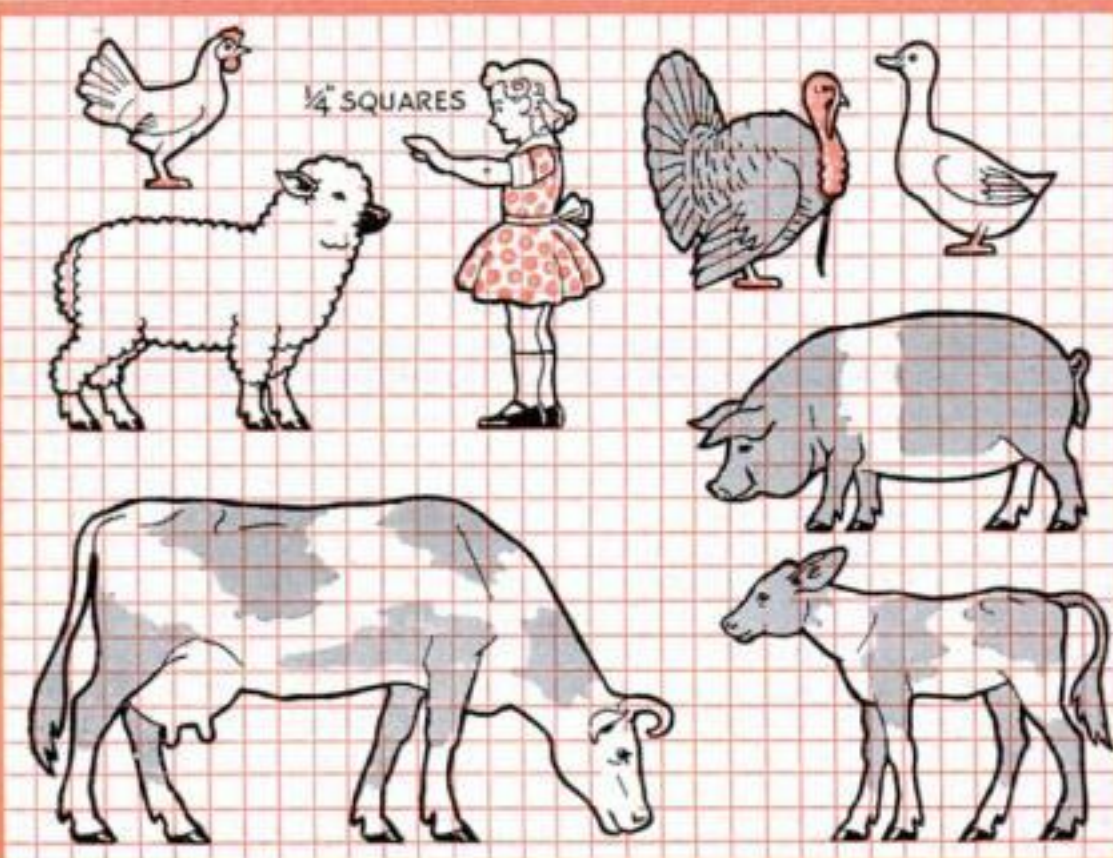
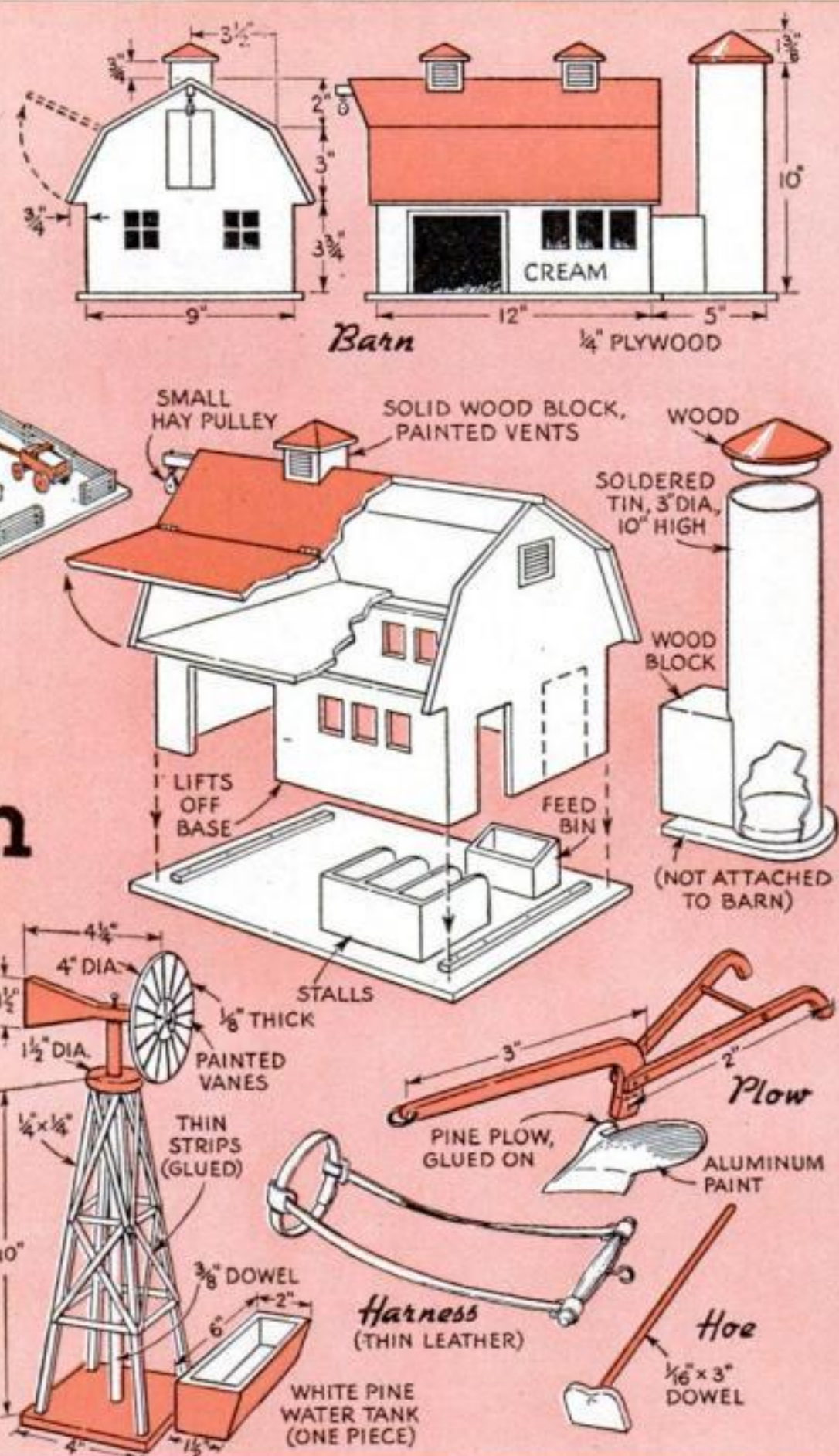


# Toy Farm

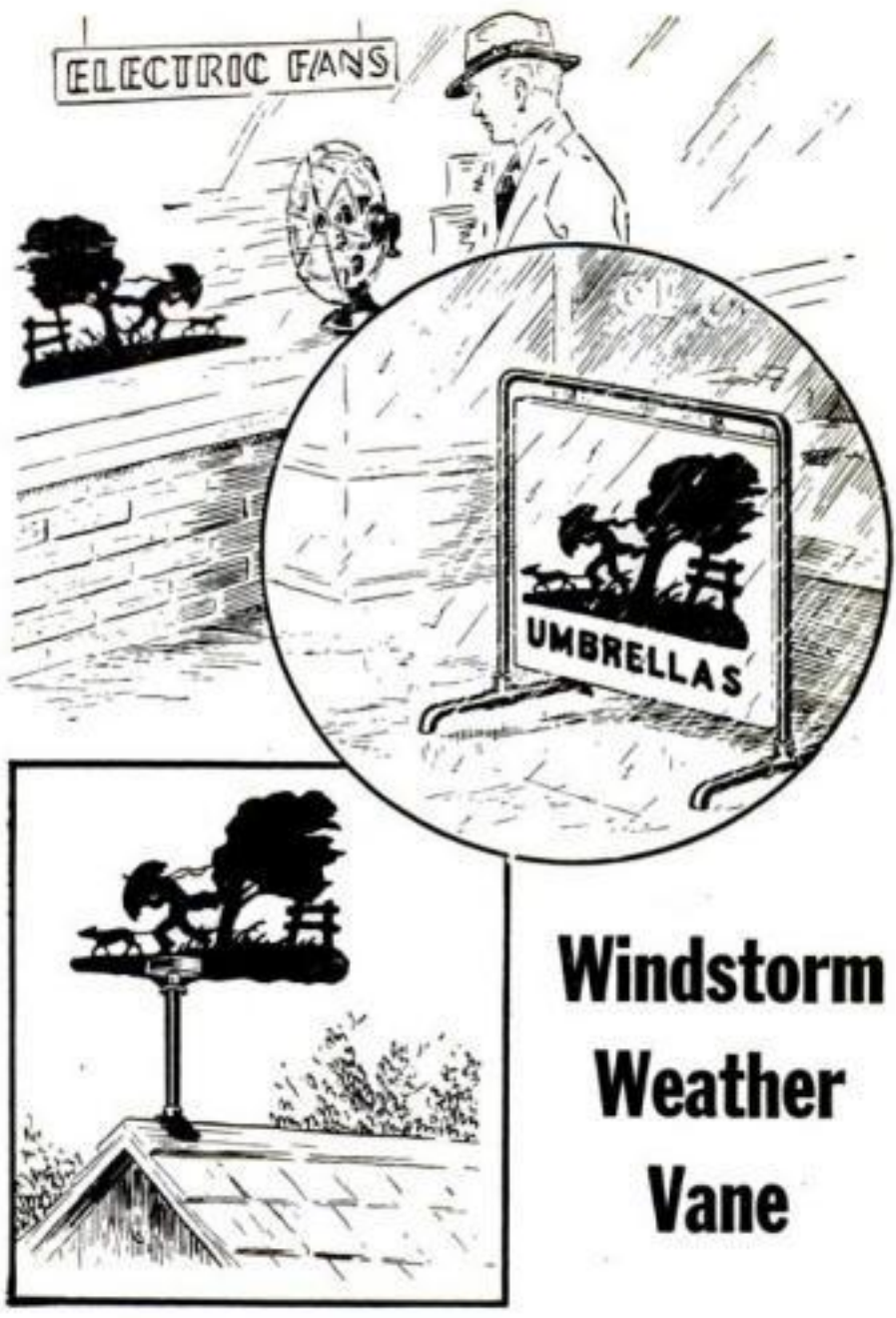
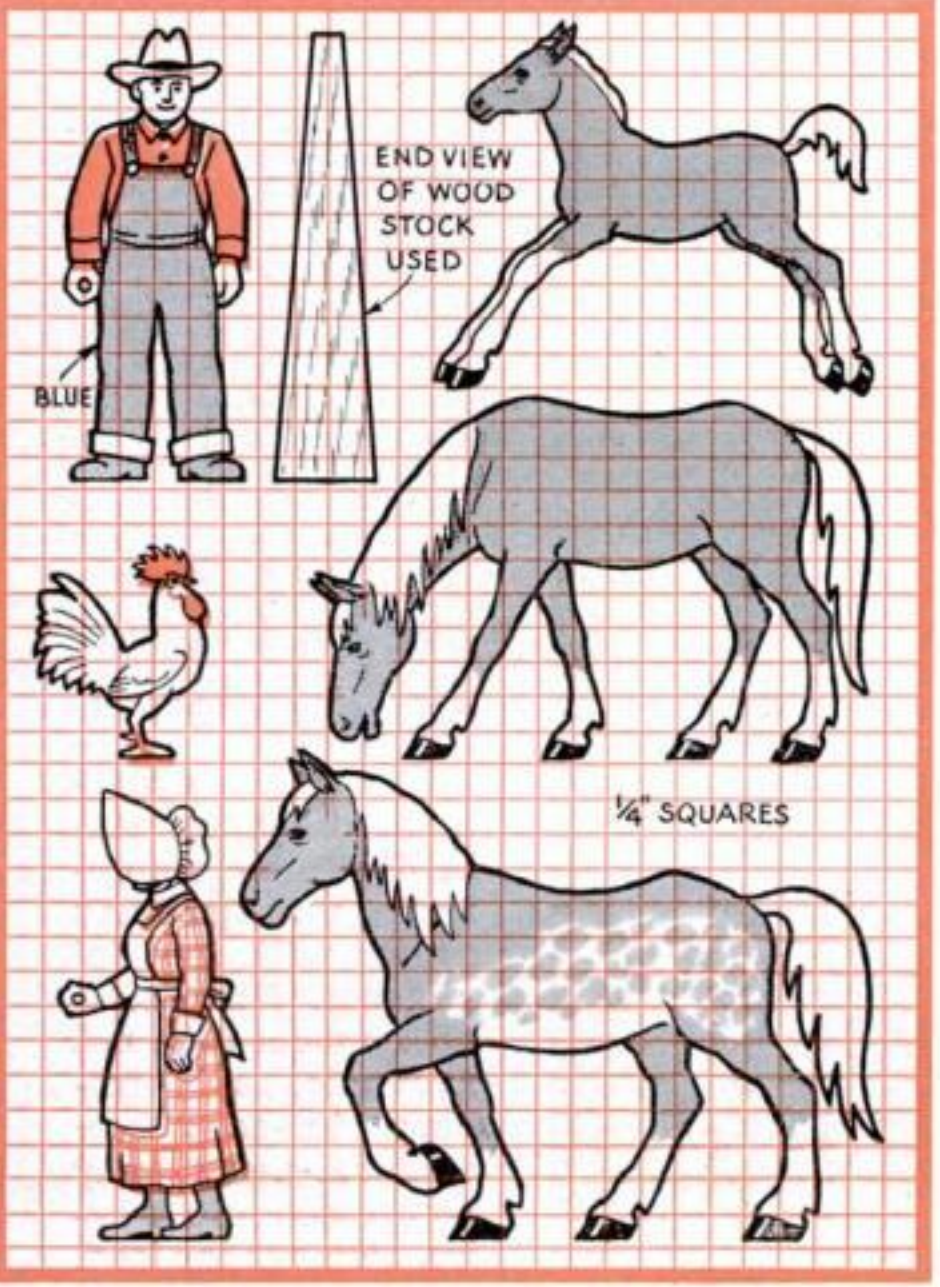
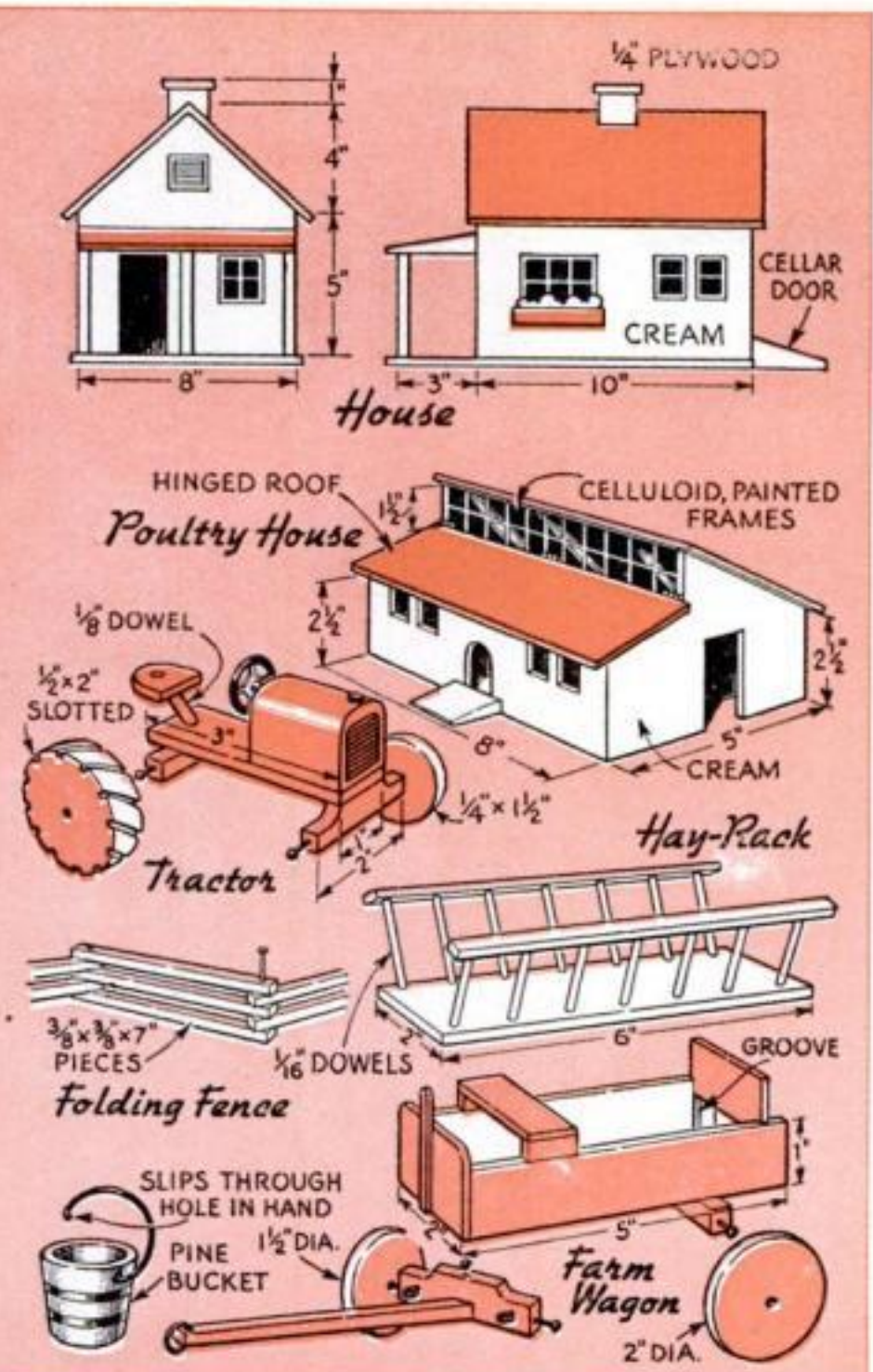
IN THIS toy farm the center of interest is the big barn, which is made to lift off the base so that a child can arrange the tools and tractor to his taste, and put horses or cows in the stalls. One gable has a hay window with beam and pulley. The fence, which folds up when not in use, can be made in as many sections as required.

Small metal tractors may be bought, but one can easily be built of wood as shown except the steering wheel, which can be taken from a discarded toy. The hay rack and farm wagon have identical running gear. The plow frame can be made of hardwood, with a combined plowshare and moldboard shaped from white pine. Paint the share and moldboard aluminum, the tongue black, and the handles red.

Figures and animals will stand alone when sawed from wedge-shaped material. The man and woman have holes drilled in their hands to receive various small tools, a halter rope, or the handle of the milk pail.—HI SIBLEY.

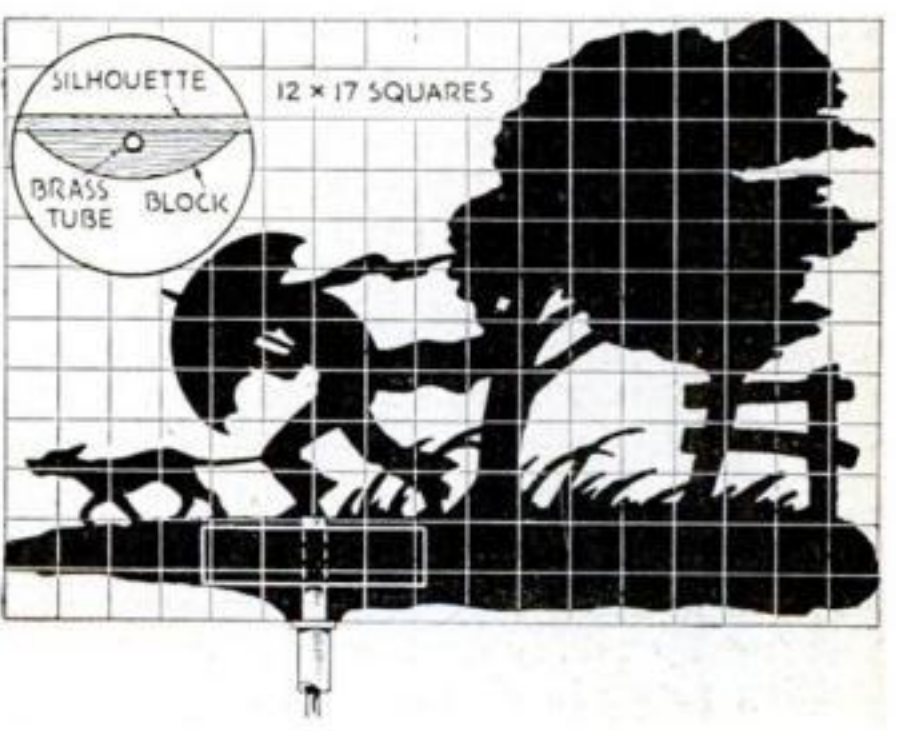






ALTHOUGH designed originally for use as a weather vane, this silhouette can be adapted to other purposes. It would, for example, make an appropriate advertising panel for electric fans, umbrellas, rain-coats, and the like.

For outdoor use the silhouette can be cut from either waterproof plywood or sheet metal and mounted as required. If 1" squares are drawn as an aid in enlarging the design, the finished project will be a good size for a weather vane. To change the size, simply lay out larger or smaller squares before starting to copy the pattern.





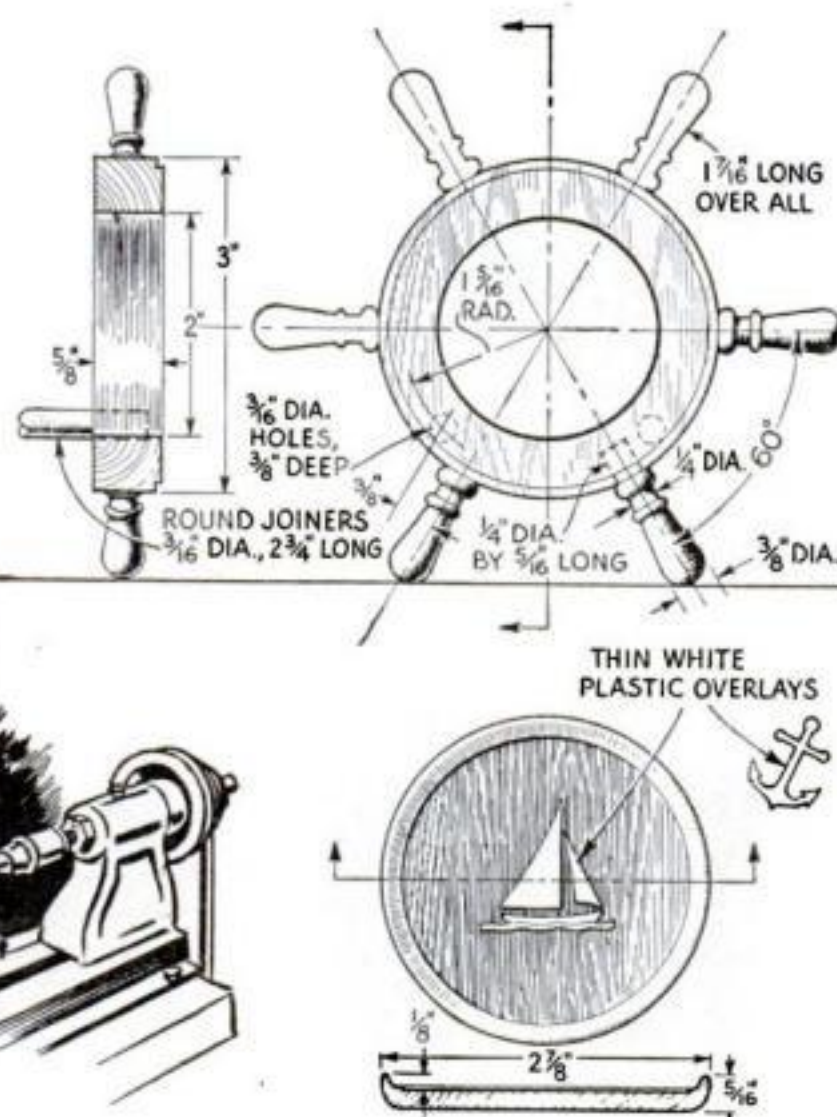
# Marine Coaster Set Turned on a Lathe

  
**CLOCKED  
PROJECT**  
Average Time  
3 hours

THIS coaster set is a through-and-through lathe project for the yachtsman who is casting about for something nautical to turn his hand to. Start with the spoke handles, three of which are turned from one piece of stock, then cut off, and the small stubs sanded smoothly. Next the ring members of the wheels are tooled out from one piece. The lathe index head serves nicely to mark places every 60 deg. for the spoke handles. A tailstock crotch center is handy for drilling the spoke-handle holes with a headstock chuck and drill. Holes for the joiners are drilled, then the joiners are turned and glued into them. Glue in the spoke handles at this time.

The eight coasters are cut from one piece of stock. Allow room between each one to ply the tool, and afterward cut them apart. Do as much of the sanding as possible in the lathe, of course, before removing the pieces. If made accurately, the coasters will nest snugly.

Stain the pieces after assembly, and cement small, white plastic yachting emblems on the coasters to give life to the project.—**BRUCE MACINTOSH.**



A tailstock crotch center holds the ring while drilling

## Toy Wheels from Rolling Pins

IN MAKING toys the matter of wheels is somewhat of a problem to one who does not have a lathe. I merely purchase ten-cent rolling pins for small wheels, and fifteen- or twenty-cent rolling pins for larger wheels, and saw them across on my bench saw. Being hardwood, the pins make good wheels. For softwood wheels, cheap curtain poles offer suitable material.—**ARTHUR ROBB.**

• • •

THE loud ticking of an alarm clock or other clock housed in a metal case can often be cured by taking off the back and fitting blotting paper inside this piece.



## Leather Work Tooled with Empty Pencil

LEATHER craftwork is often embellished by stamping background areas with special punches. When suitable punches are not available, an ordinary ten-cent mechanical pencil may be pressed into service. Remove the lead.

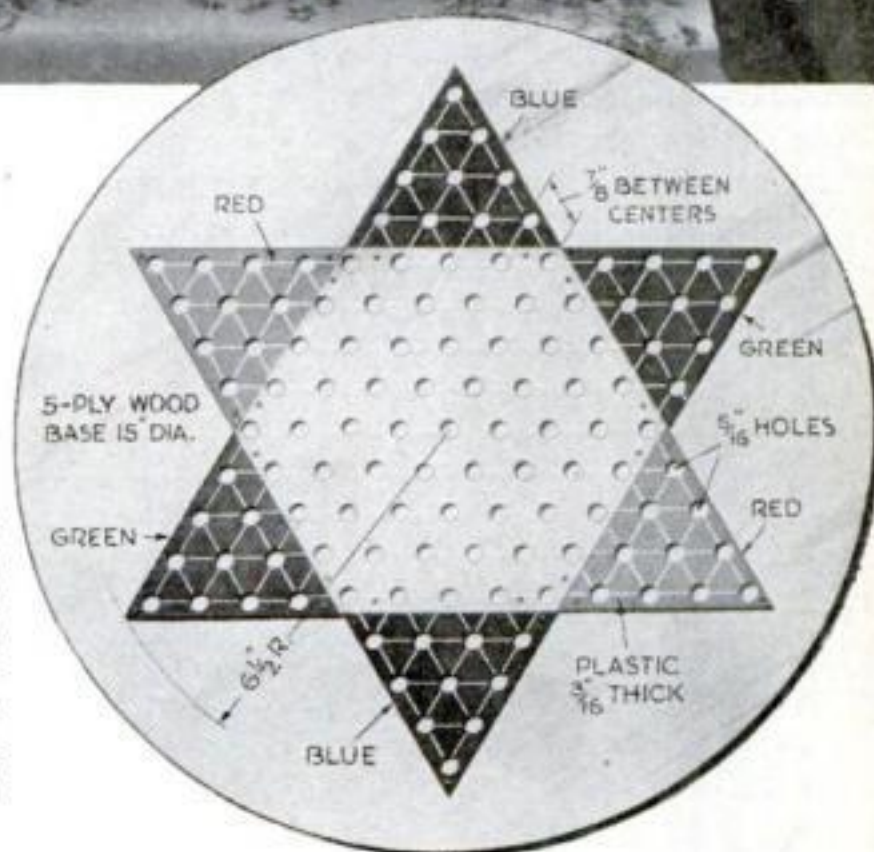


# Gay Plastics Ornament Chinese Checkerboard

CAST-RESIN plastics, which lend an air of distinction to so many kinds of craftwork, can be used to enliven a Chinese checkerboard. The 15" diameter base is cut from five-ply plywood from  $\frac{3}{8}$ " to  $\frac{3}{4}$ " thick, and the hexagonal center and the triangular points are  $\frac{3}{16}$ " plastic. Draw a full-size pattern on paper. The hexagon can be laid out in a circle  $7\frac{1}{2}$ " in diameter, in which case its sides and the sides of the triangles will be  $3\frac{3}{4}$ " long. Scribe clear, uniform lines across the surface of the plastic material with any sharp-pointed tool, and drill  $\frac{5}{16}$ " holes at the intersections. After the base has been lacquered, the plastic parts are fastened to it with small drive screws. A box for the marbles may be turned from maple or other hardwood to the dimensions given below.



Top view of the board and, left, marble box. The design is from New York headquarters of the Metropolitan Junior Achievement



## RESISTS

## [ METAL ETCHING—2 ]

There are numerous resists or mediums for blocking out and coating metals before they are etched with acids.

Of the waxes, paraffin is widely used, being cheap and always available. The melted paraffin is poured over the metal, which, to obtain best results, should be warm. This gives a thin, even coating. Paraffin and other waxes, however, often prove more or less unsatisfactory, particularly where the design is being scribed in. If the coating becomes too cold and hard, it will chip; if too warm, it will pull.

Asphaltum varnish is the most satisfactory resist for most decorative metal work. When it is allowed to dry hard, it will cut well and leave clear, sharp lines. Asphaltum becomes stiff in cold weather. Keep the can in a warm place, but not too close to a fire. If, when warm, asphaltum is still too thick to spread well, add a little turpentine. An inexpensive material sold in ten-cent stores under the name "stovepipe enamel" is often an excellent grade of asphaltum of just the right consistency to spread well.

Asphaltum is best removed from the metal with kerosene. Lacquer thinner is equally satisfactory, and turpentine will also do the work, although it is slow.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



# Putting Your SKIS in Shape

By **ART HOLMES**

Ranger, Yosemite National Park

**A**RE your skis ready for the first snows? A little pre-season maintenance now will prolong their useful life and improve their performance.

Start with the bindings. Take them off entirely and check their condition. Steel-wool any rusty places, and oil or shellac them. Repair or replace any worn or weak parts. When you refasten the bindings, see that all the screws tighten down firmly. Some of the holes in the wood may have become enlarged and require oversize screws.

Frequently, after a year or so of hard usage, the inside edges of skis not having metal edges will be found to be worn and rounded. This makes skiing—particularly climbing—difficult. Sharp edges may be restored by switching bindings from one ski to the other, which brings the sharper edge of each to the inside. Another way would be to plane down the inside edge of each ski.

Now check the ski tops. It is a good idea to revarnish these surfaces if they are worn or scratched. This improves the appearance and helps to prevent cracking and warping; furthermore, snow will not stick to the slick, shiny surface. Before revarnishing, clean off all wax and dirty spots with turpentine, alcohol, or a cleaning solvent. Sand with fine sandpaper, and fill all pit holes and deep scratches with putty or plastic composition wood, stained appropriately. Apply several coats of spar varnish, allowing the skis to dry thoroughly between coats. Never varnish the bottoms.

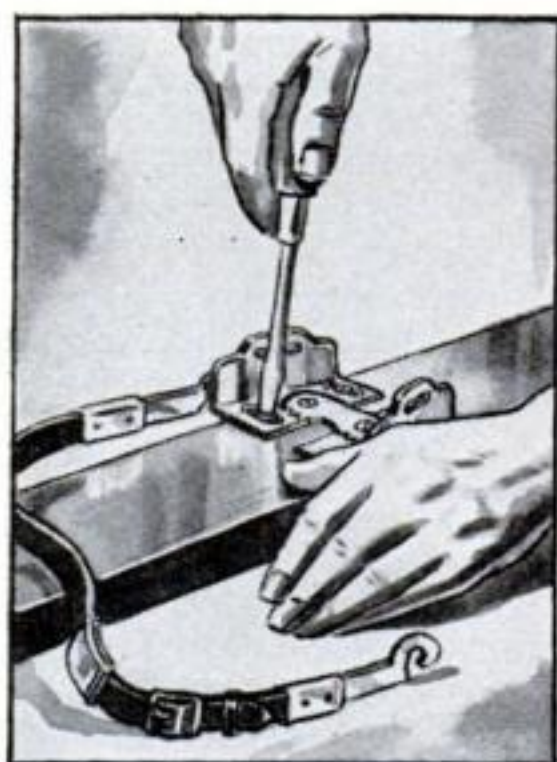
If you want to add a mark of distinction to your skis, paint a small monogram or design just back of the tips. This has a distinct value other than an ornamental one—there is less danger of losing your skis by mistake or design.

Attention must now be given to the bottom or running surfaces. Even new skis usually require a base wax or lacquer treatment before use. The present trend of base treatment is toward the new ski-lacquer preparations, and in many localities this is entirely superseding the old base-wax method.

Wipe the skis with turpentine or alcohol and sand them thoroughly before applying the lacquer. Be absolutely sure there is no old ski wax or other oily preparation on the surface. Lacquer will not stick if the slightest trace of wax is present. In case, however, the skis have previously been treated with linseed oil, lacquer will usually adhere provided the linseed oil has been on some time, is thoroughly dry, and has penetrated into the pores. Always clean and sand well.

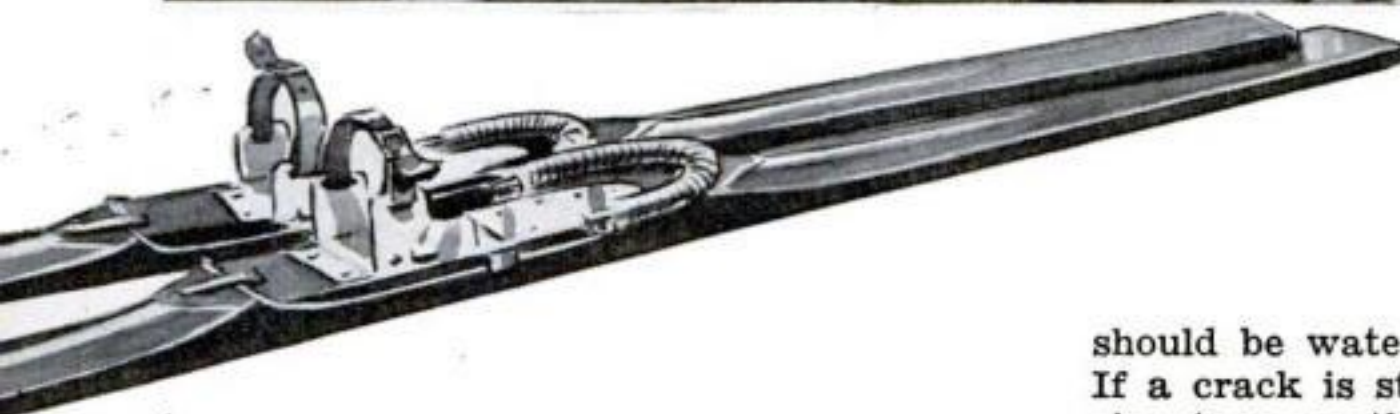
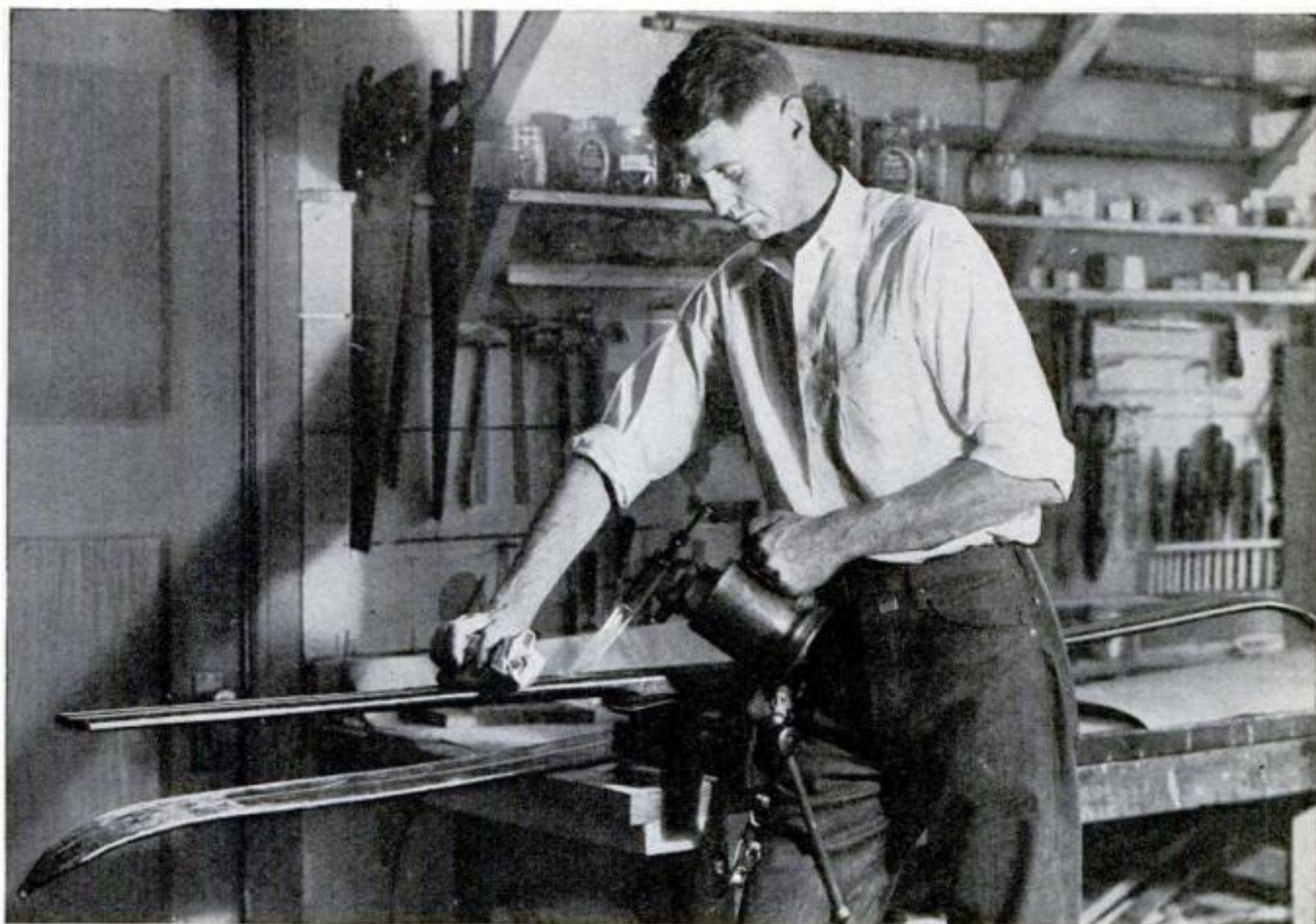
If a lacquer base is not to be used, then the wood should be impregnated with linseed oil or wax to make it waterproof. Otherwise the top waxes (climbing or downhill) will wear down and expose the wood, which can soon become wet and wear rapidly.

The linseed-oil process is very simple. Clean off all old wax as previously described or by using gasoline. Then brush on coats of hot linseed oil until the wood has taken up all that it can. The excess may be wiped off and the skis allowed to dry, after which a



To replace a worn-out ski-pole handle, you can't beat a bicycle handlebar grip. When inside edges of skis become rounded, change bindings from one ski to the other





While the running surface of the ski is heated with the constantly moving blowtorch, the wax is spread with a cloth

good coat of wear-resisting base wax may be applied.

The other process consists of burning in the wax. Put the ski in a vise and, taking one third of the length at a time, slowly heat the ski with a blowtorch. Keep the torch constantly moving and exercise extreme care not to burn the wood. At the same time, spread a thin coating of wax on the surface with a rag. This wax penetrates the pores of the wood. The wood may be heated to the point, but no more, where tiny bubbles appear on the surface; then immediately allowed to cool. The usual base wax and top waxes are applied on top of this wax treatment.

At this time check the condition of the steel edges, if your skis have them. Replace bent or broken sections and tighten or replace loose or missing screws. Fill each hole with linseed oil before fastening the new screws in place.

Examine your ski poles next. The shank

should be waterproof to prevent cracking. If a crack is starting, wrap wire or adhesive tape neatly around that portion, and varnish over the tape.

Frequently the leather thongs holding the ring to the shank become stretched or worn, and lose their natural oil. Replace broken or stretched thongs, and rejuvenate with boot grease. Also inspect the ring itself. If it is of rattan, it may need varnishing or shellacking.

An inexpensive replacement for the handle is the familiar bicycle handlebar grip. Slip this on the end of the ski pole, bore a hole through the grip and pole large enough to accommodate the wrist strap, and rivet the strap ends together to form a loop of the right size.

## Outdoor Wiring Accessories

BECAUSE the common hard-rubber or composition variety of electric sockets and plugs tend to break up when exposed to frost, those used on lamp and extension cords intended for continuous outdoor service should be of the heavy-duty, soft-rubber type.—J. M.

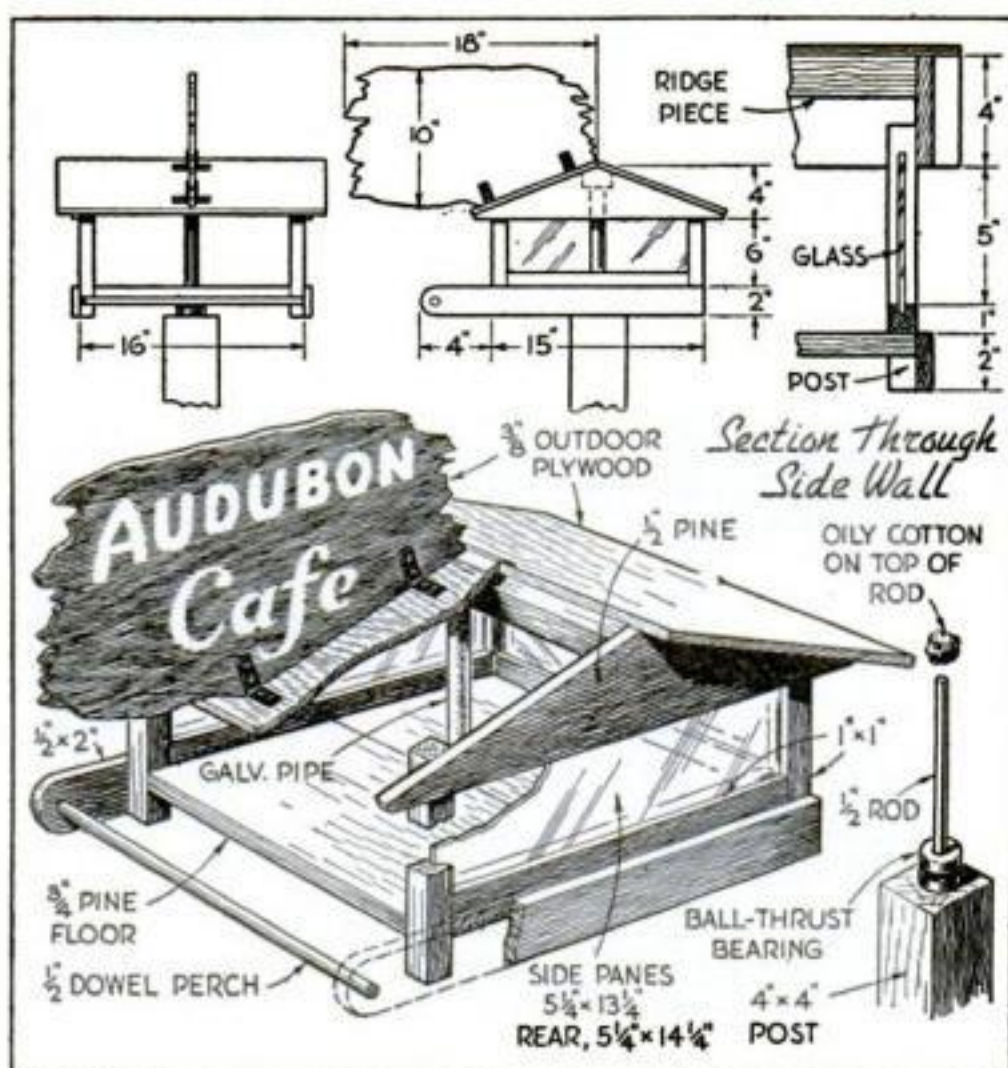




## A Revolving Bird Feeder Built with Glass Sides

THIS sunny, snug bird feeder swings with the wind and protects its feathered patrons at their meals. Waterproof outdoor plywood is used for the roof, and white pine for the posts, floor, and sturdy ridge piece into which the galvanized pipe is inserted at the top.

The panes of glass are set  $\frac{1}{8}$ " into rabbets  $\frac{3}{16}$ " deep. The load is carried on a ball-thrust bearing, and a wad of oil-soaked cotton is plugged into the top of the pipe



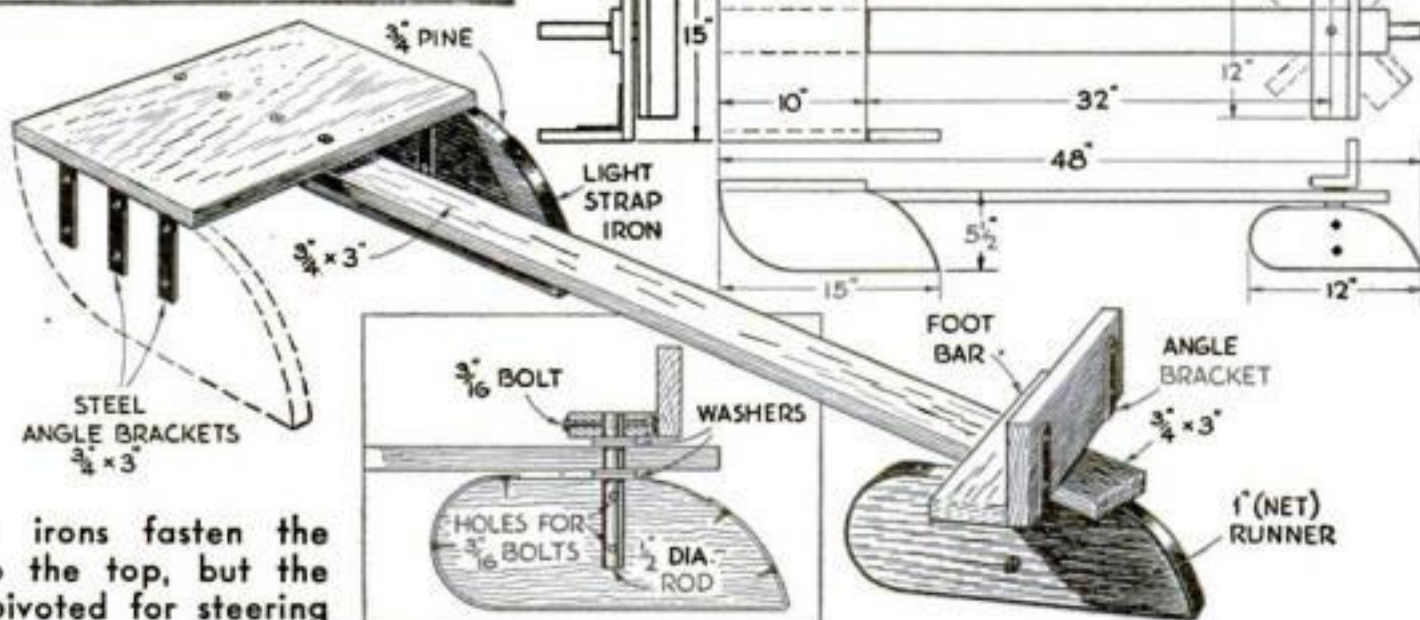
to keep the axis from squeaking as the shelter revolves with the wind. Finish with outside spar varnish in the natural wood. Add the lettering in bronze or aluminum with fine black borders.

Locate the feeder out of the reach of cats, but not too high to replenish the grain and suet.—DICK HIXON.

## Three-Runner Snow Scooter Steered with the Feet



These tricky little sleds add a new sense of adventure to coasting. A boy has to stretch out on the sled as if he were part of it



Ordinary angle irons fasten the front runners to the top, but the rear runner is pivoted for steering

ANY boy can create a real sensation on his local coasting hill by appearing with a T-square scooter of the type illustrated. It requires only the simplest carpentry to construct. There are two rigidly fixed runners in front, and a single pivoted runner in the rear for steering. The runners are shod with light strap iron.—H. S.



# Metal Decoys Aid in Spearing Fish Through Ice

DECOYS to use in the sport of spearing fish through the ice from a fish house—a sport that is popular in many of the colder sections of the country—can be made as shown from sheet metal or heavy tin. The decoys may be from 3" to 8" long and patterned after any desired kind of fish.

Cut the metal to shape with tin snips or cold chisel, hammer it flat, cut slots for inserting the fins, and solder the fins in place. Add extra solder under the frontal fins so that the decoy will glide downward when the control string is slack. Drill a few small holes along the top edge for inserting a small hook and swivel.

For running the decoy, a stick about 18" long with a 6' or 8' fishline is used. The hook and swivel are tied to the end of the line. See that the fins of the decoy are horizontal except the back edges of the frontal fins, which are bent up slightly. Bend the body of the decoy to form an arc so that it will travel in a circle of from 12" to 18". Insert the hook of the control line in whichever hole permits the decoy to balance properly. The decoy may be left in its natural finish or colored, as preferred. A red head with a white body is a good color combination.

The fisherman usually sits by the edge of the ice hole and gives the control line slow jerks with one hand so the decoy will travel in circles. He holds the spear in the other hand and rests the tines at the edge of the hole until a fish is seen. The spear is ordinarily 4' or 5' long.

Decoys of this type can also be used as summer bait by drilling a small hole at the nose and tail. Fasten a gang hook at the tail and a small swivel at the nose. Bend the decoy so it will travel through the water like a crippled minnow.—D. E. LINDBERG.



## Skates Given Keen Edge with Half-Round File

A SKATE sharpener can be made by clamping a half-round file between two wooden blocks in a bench vise and drawing the run-



ners of the skates across the rounded surface of the file. Select two sound pieces about 1" by 1" by 5" and saw a V-shaped groove the length of each block; then shape the groove with the edge of the half-round file so the file can be held securely as shown in the detail drawing. The channel should be equal in width to the runner.—JOHN LAPIN.

## Screen and Storm Doors Hinged to Avoid Unnecessary Holes

PUTTING up and taking down interchangeable storm and screen doors soon enlarges the hinge screw holes, making it necessary either to plug them or change the position of the hinges. To avoid this, I screw the hinges permanently to the door frame and fasten them on the screen or storm door with flathead bolts and nuts. Thus the hinges need never be moved during the life of the door, and the door frame is not mutilated with holes.—WILLIAM F. PETERSON.





# Balsa Wood for Model

## PART II

By FRANK ZAIC

**W**E ARE led to believe that extra-light balsa is best for model work to achieve maximum strength with minimum weight. This would be true if a model behaved perfectly from the first to the last flight, and did not meet unexpected obstructions. As a rule, however, models have to withstand severe and sudden shocks. A rigid spar cut from light balsa might crack under sudden impact because it lacks resiliency. In contrast, a spar cut from heavier balsa and of smaller cross section will bend under the impact. As the spar bends, it will gradually absorb the impact force, which is dependent on speed and weight.

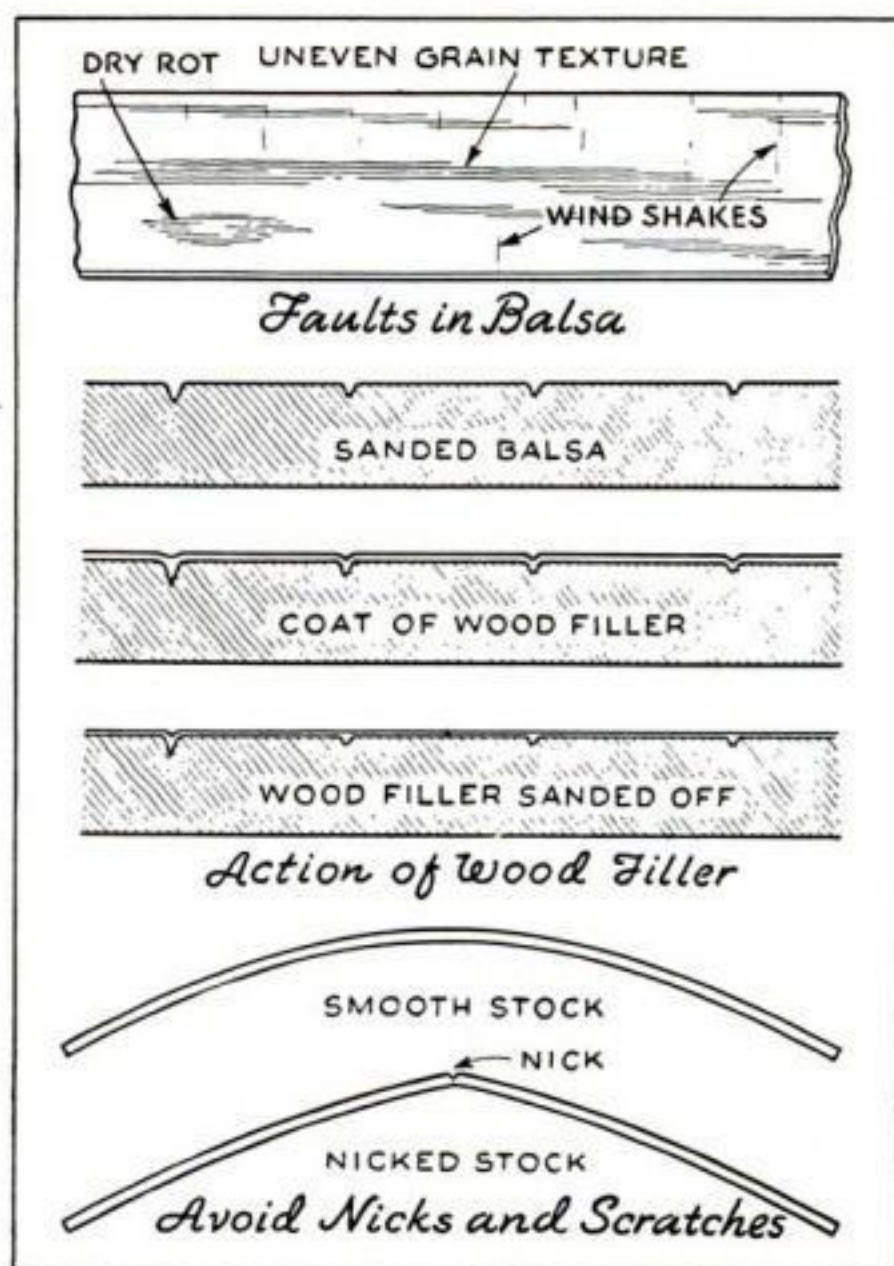
*Selecting Balsa by Weight.* For the ribs, bulkheads, sheet covering, shaping blocks, all balsa outlines, and other parts of a model which are not expected to carry sudden loads, use light balsa that weighs from 6 to

9 lb. per cubic foot. Spars, longerons, stringers, struts, and all parts expected to be highly stressed should be made from stock weighing from 10 to 15 lb. The grading from light to heavy, in each individual category, should be governed by the size and weight of the model.

It may be helpful to know that the texture of the balsa varies from pithlike at 4 lb. to almost hardwood characteristics at 20 lb. The transition period seems to be around 9 lb. That is, balsa below this figure will tend to "snap" when overloaded, and stock above this number will tend to "kink" or break like hardwood.

Not only weight, but quality is important. Balsa having intermixed hard and soft growth spots, dry rot, or wind shakes should be used only for shaping and carving. Stock that has deep scratches or saw marks should be sanded smooth. Cuts have a tendency to concentrate the entire load at their points and so break before the general overload is reached. It is also poor practice to finish a job with coarse sandpaper. Such paper breaks up the surface fibers and pro-





# Airplanes

duces deep grooves. After rough sanding, follow up with the finest grade you have. A glass-smooth, saw-cut surface is best.

**Workmanship.** Use sharp knives and razors. Dull edges will tear fibers and produce ragged ends. One secret of fine workmanship is to use light and generously sized balsa wherever curve cutting and shaping are needed.

With hard stocks there is a tendency for the razor to follow the grain instead of the template. Also, thicker but light sheet stock allows generous use of fine sandpaper when removing the rough and high spots. Thin sheets, which tend to sag between supports, allow very little sanding, and the wood must be left in natural state.

Wherever balsa is exposed to handling or weather, it should be treated with model dope or a similar liquid. The specific methods for finishing balsa under various conditions are as follows:

**Thin Balsa Sheets.** Ordinary dope will warp unsupported light sheets (all-balsa wings and tails) unless it is treated with castor oil to make it flexible. Add about ten

drops per ounce of dope. Mix well and allow to settle for several hours. Apply on a test sheet. If it still warps, add more oil; and if it remains tacky after an hour, add more dope. Apply two coats, and sand after each with 10-0 sandpaper.

**Natural Finish for Thick Balsa.** (Motor sticks, glider fuselages, propellers, and other thick balsa parts.) Apply several coats of straight dope with in-between sandings with 10-0 paper. To obtain an extra-strong skin like celluloid, add cement to dope. Use four coats with 10-0 sanding after the first two, and use wet 320 or 360 waterproof silicon-carbide paper on the last two coats. Ordinary sandpaper will clog up with thick dope-cement particles; nevertheless, the wet type of sanding cannot be used until the balsa has been well waterproofed by the early coats of dope. When waterproof paper is used in wet condition, it keeps its abrasive qualities much longer. For a fine finish, rub down the surface with a rubbing compound and polish with wax.

**Color Doping.** (Solid models, boats, and other display items.) Apply one coat of clear dope. This will close the pores or grain trenches, but it will not fill them. It merely prepares the surface for wood filler. The function of the wood filler is to form a sandable skin on the balsa contour. Sanding removes the filler from the high spots and leaves it in the valleys. So porous a wood needs several layers to do the filling effectively. Use filler prepared for balsa.

Regular colored dope or several layers of dope-and-cement mixture may be used as a filler, but it will require more work for good results. Sand the first two layers of filler with sandpaper until the balsa surface is reached at the high spots. Add two more coats. Then use wet 320 or 360 paper. Be careful not to use it on exposed and unprotected balsa as it will produce blisters and cause delay until it dries. When the surface is filled sufficiently to have an unbroken look, it is ready for doping.

For best results use thin color dope and apply it with a soft sable brush. Apply a coat and wait for about an hour before brushing on the second. Now wait for three hours before you smooth it with wet 400 paper. If the work must be extra fine and rich, add more coats with in-between sanding. Do not start too soon with the dope because it sets slower than the filler; and do not work too briskly or the friction might heat the dope and allow it to be rubbed away.

After the job has been completed to your satisfaction, one or two coats of banana oil will provide a high gloss, which may be toned down to a more artistic "used" look with rubbing compound and wax.

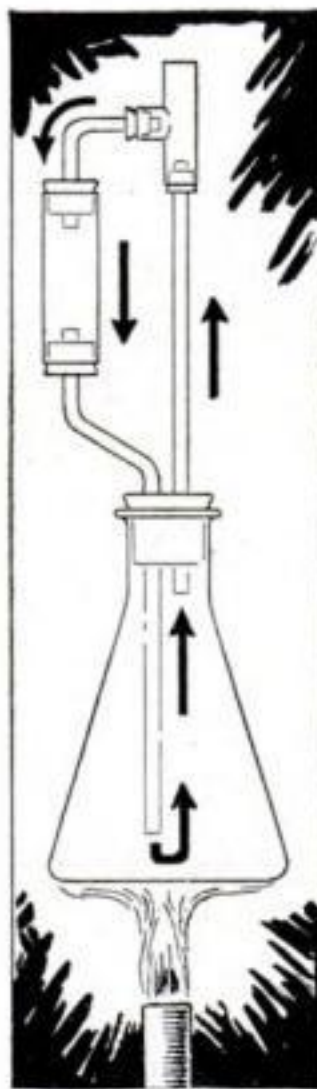


# SCIENCE STUNTS

**W**ITH homemade models, or the simplest of chemical glassware, you can learn as much about heating plants in a few minutes as might take several seasons of costly experience. Principles illustrated in these five easy experiments explain the "why" of important points in regulating and caring for a furnace or boiler. Ignorance isn't bliss on a cold winter day, for even the best heating system can perform only as well as its owner tends it. By understanding the way that it works—which will turn out to be surprisingly simple after all—he can assure himself during the cold months of a maximum of comfort and a minimum of fuel cost.

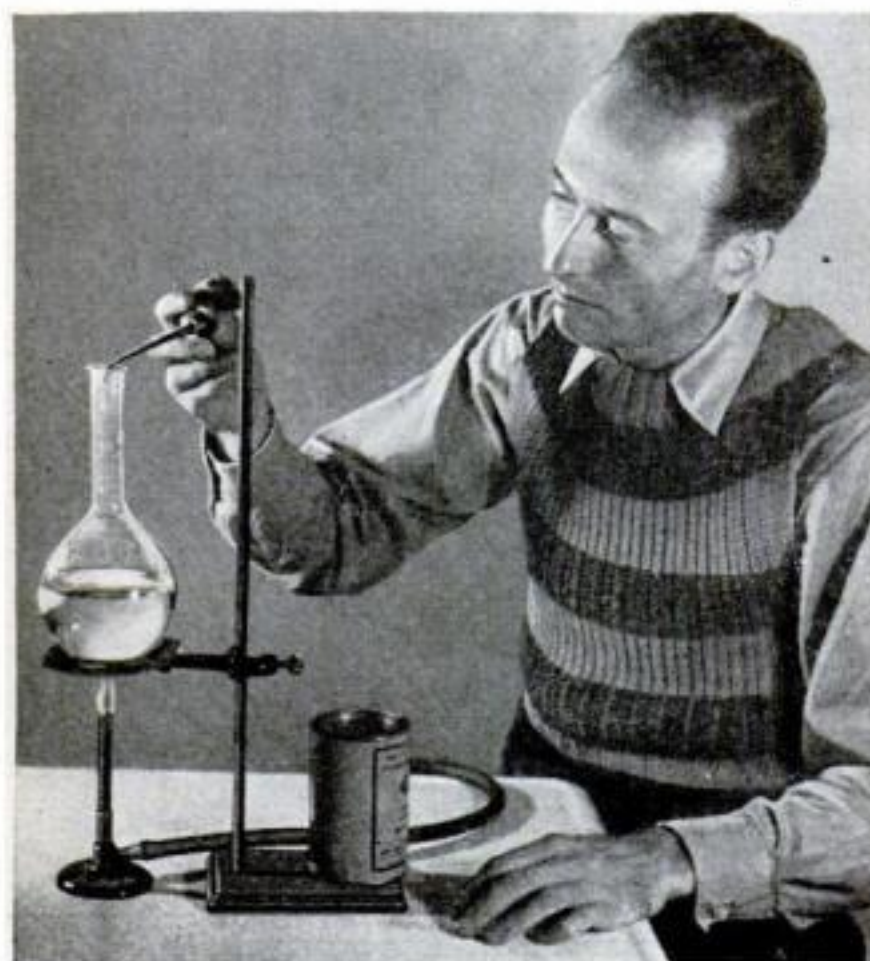


Colored water circulates in model hot-water plant



## HEATING WITH HOT WATER.

For the model heating plant shown, a flask will serve as a boiler, a large tube as a radiator, a T tube open at its top as an expansion tank, and connecting tubing as piping. Fill the flask with colored water, and the rest of the system with clear water. Heat the flask with a Bunsen burner. As the heated water expands, it gets lighter and rises to the T tube. Then, cooling, it descends through the "radiator" and finally returns to the "boiler," completing its round. Coloring the contents of the flask makes it possible to follow the path of the hot water in its course around the miniature set-up.



Water containing oil is slower in coming to a boil

**OIL IN WATER WASTES FUEL.** Put some pure water in a flask, and bring it to a boil. Note with a watch exactly how much time this requires. Now try the same experiment with an equal quantity of water, to which you have added a few drops of oil. This time the water will take considerably longer to boil. Moreover, a higher flame beneath the flask will be needed to keep the contents boiling. The reason is that the film of oil upon the water increases the surface tension, making it more difficult to turn the water into steam. Similarly, new heating systems often waste fuel because of the presence of oil in pipes, radiators, and boiler tubes. In order to remove the oil, the boiler must be "blown"—that is, emptied of water through a blow-off pipe while under steam pressure. Or a special compound may be added to the boiler water, which then is drained and replaced with fresh water. Care must be taken, however, not to drain the boiler when there is a hot fire in the firebox, otherwise the boiler may be damaged.

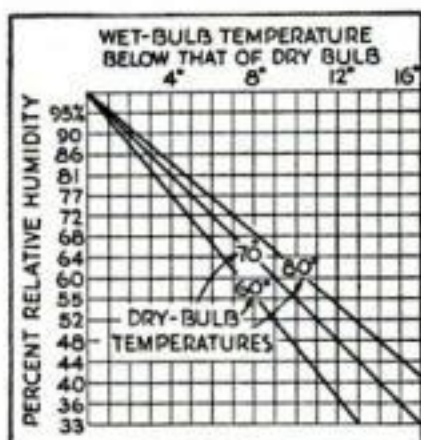


**SOOT ADDS TO FUEL BILL.** Place a beaker containing a measured quantity of water upon a clean piece of sheet iron, and set the iron over a flame. Note the exact time it takes the water to come to a boil. Then coat the under side of the iron plate with a thick layer of soot, by leaving it for some time over a yellow gas flame. Using this plate, repeat the first experiment. You will find that it takes a longer time to bring the water to a boil, since the black coating acts as an insulator against the passage of heat. Innocent-looking soot in furnace flues acts in exactly the same way. Careful tests by heating engineers prove that a coating of soot only an eighth of an inch thick may mean a fuel loss of as much as twenty-five percent. It may be seen from this that cleaning the flues at proper intervals will result in a definite saving on the winter's fuel bill.



A layer of soot on the metal plate delays heating

**TEST FOR HUMIDITY.** Being comfortable in your home, during the winter, involves not only the temperature but also the amount of moisture in the air—the relative humidity. To test it, note the reading of a thermometer; then wrap the thermometer bulb in wet cotton and hold it in the breeze of a fan. The thermometer reading will drop, to a level depending on the dryness of the air. When it has reached its lowest point, subtract the “wet-bulb” reading from the ordinary one. The accompanying graph will then show the relative humidity, which should be about forty percent, at seventy degrees, for health and comfort.



Taking a wet-bulb reading for relative humidity

**COFFEE-CAN FURNACE.** Punch a few holes near the bottom of a can, to represent the ash-pit draft, and attach a tin tube for a chimney. With a candle for a fire, you have a heating plant in miniature, which can be observed through a window tightly covered with a piece of mica. Obstruct the draft holes or chimney, and the “checked” flame burns dimly. A fan breeze over the chimney opening increases the draft and brightens the flame, as does a “forced draft” produced by pointing the fan at the lower holes. Deflecting a breeze from the chimney, as at right, reduces its effect.



How a building obstruction cuts draft from a breeze



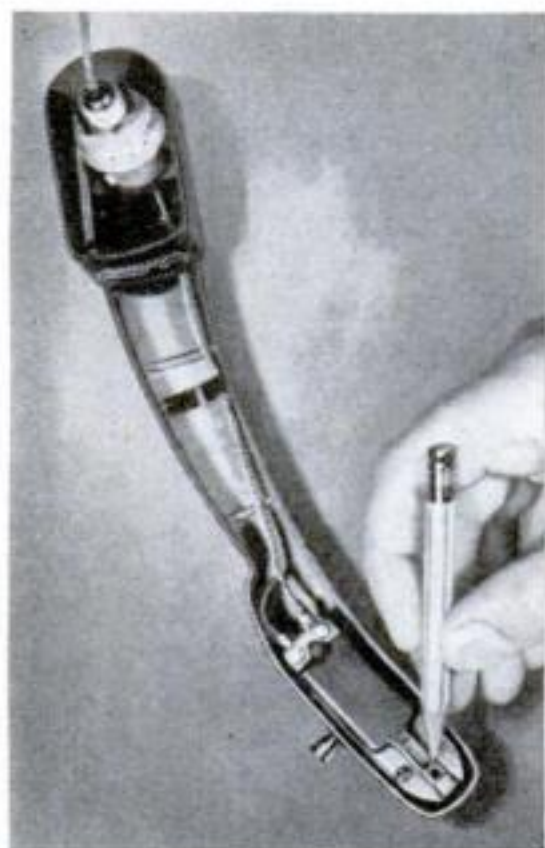
# RADIO



**TABLE-LAMP RADIO.** Built into the bakelite base of this attractive table lamp is a five-tube radio receiver with a dynamic speaker. A knob controls the on-off switch, and tuning is accomplished by turning the revolving dial in the base with the tips of the fingers

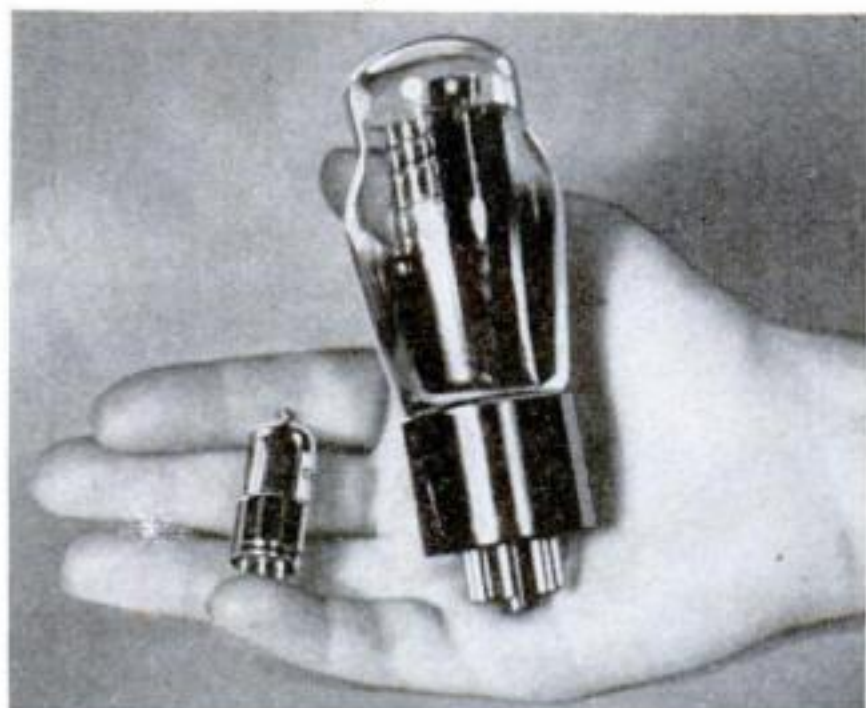
## JEWEL PICK-UP NEEDLE

The new crystal pick-up below has a permanent jewel stylus of fine sapphire that is said to last a lifetime. The stylus is guarded by a spring mounting (indicated by the pencil in the photograph) which prevents harm if the pick-up arm is dropped



**CABINET TOUCH-UP KIT.** Six different shades of high-grade lacquer are supplied in a handy kit for touching up plastic and colored cabinets. The colors are walnut, ivory, black, red, blue, and green. Bottles holding the enamel have plastic tops with attached brushes for applying it to cabinets

**TINIEST RADIO TUBE** is the 1/4-inch midget shown below in contrast with a standard-size tube. Its plate-current drain is so low that it cannot be measured on a milliammeter! These tubes are available with tinned leads, or with a five-prong base





# IDEAS

**HEAT-RADIATING TUBE CONNECTOR.** Designed to protect the glass seals of transmitting tubes from damage by overheating, connectors of a new type are fitted with vanes that give additional surface for heat radiation. The connectors are available in four different sizes



**RECORD CHANGER.** Any radio becomes an automatic phonograph when used with the instrument shown below. Requiring no connection with the radio, it plays eight ten-inch or seven twelve-inch records without attention

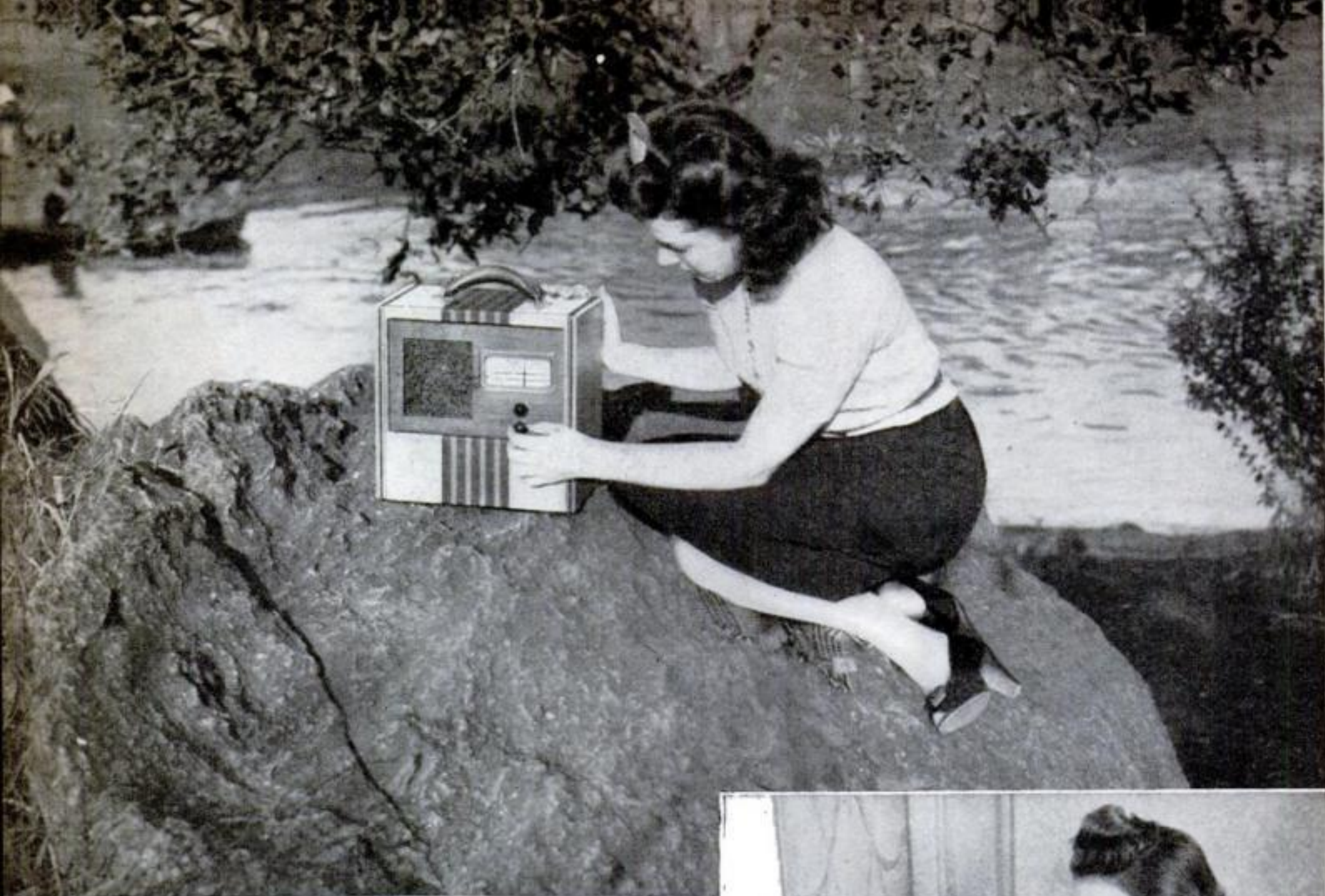


**PICK-UP FOR DANCERS' SHOES.** Amplifying the taps in tap dancing is a new job for pick-up units of the type commonly used on musical instruments. In the photograph above, the song-and-dance team of Valley and Lynne have the units attached to their insteps



**PERSONAL RADIO.** Opening the lid of this compact portable radio turns it on automatically. The built-in antenna brings in broadcasts from stations fifty or more miles away. Its small size, light weight, and economical power requirements make it ideal for outings and travel





# SUMMER- WINTER RADIO



One radio takes the place of two. The polished walnut table model works on house current. Placed in a sport case, it becomes a battery-powered portable

**C**ARRIED outdoors, the compact four-tube superheterodyne receiver shown at the top of the page is a sporty, summertime portable radio, finished in striped airplane-luggage canvas, and powered by batteries. But it takes a second look at the highly polished walnut table-model radio in the lower picture to be convinced that it is the same set, stripped of its sport clothes and formally dressed for wintertime use in your living room. As a table model, it is powered by house current, either alternating or direct.

The secret behind this all-season radio lies in the construction of a canvas-covered

outer wooden cabinet, with a carrying handle and space for a battery pack, into which the walnut-finished main cabinet can be slipped. A handy plug connector simplifies attaching the batteries, replacing the power cord used for house-current operation. Dimensions for making the cabinets are given in the accompanying drawings.

The set's circuit uses a 1A7GT tube which serves as the combined second detector, automatic volume control, and first audio tube. A 1A5GT (*Continued on page 227*)

**By ARTHUR C. MILLER**



## LIST OF PARTS

Electrolytic condensers: 40 mfd., 150 volt; 24 mfd., 150 volt; 12 mfd., 150 volt; 100 mfd., 50 volt.

Tubular condensers: .06 mfd., 200 volt; .005 mfd., 400 volt (two); .01 mfd., 600 volt (three); and .1 mfd., 600 volt (two).

Mica condensers, .00005 mfd., and .0001 mfd.

Adjustable resistor, 10 watt, 2,500 ohm.

Volume control, 1 meg.

Carbon resistors: 1 watt, 3,500 ohm;  $\frac{1}{2}$  watt, 1 meg. (two);  $\frac{1}{2}$  watt, 50,000 ohm;  $\frac{1}{2}$  watt, 70,000 ohm;  $\frac{1}{2}$  watt, 10 meg. (two);  $\frac{1}{2}$  watt, 2 meg.; 1 watt, 2,000 ohm.; and  $\frac{1}{2}$  watt, 800 ohm.

Input I.F. transformer,  
455 kc. Output, 455 kc.

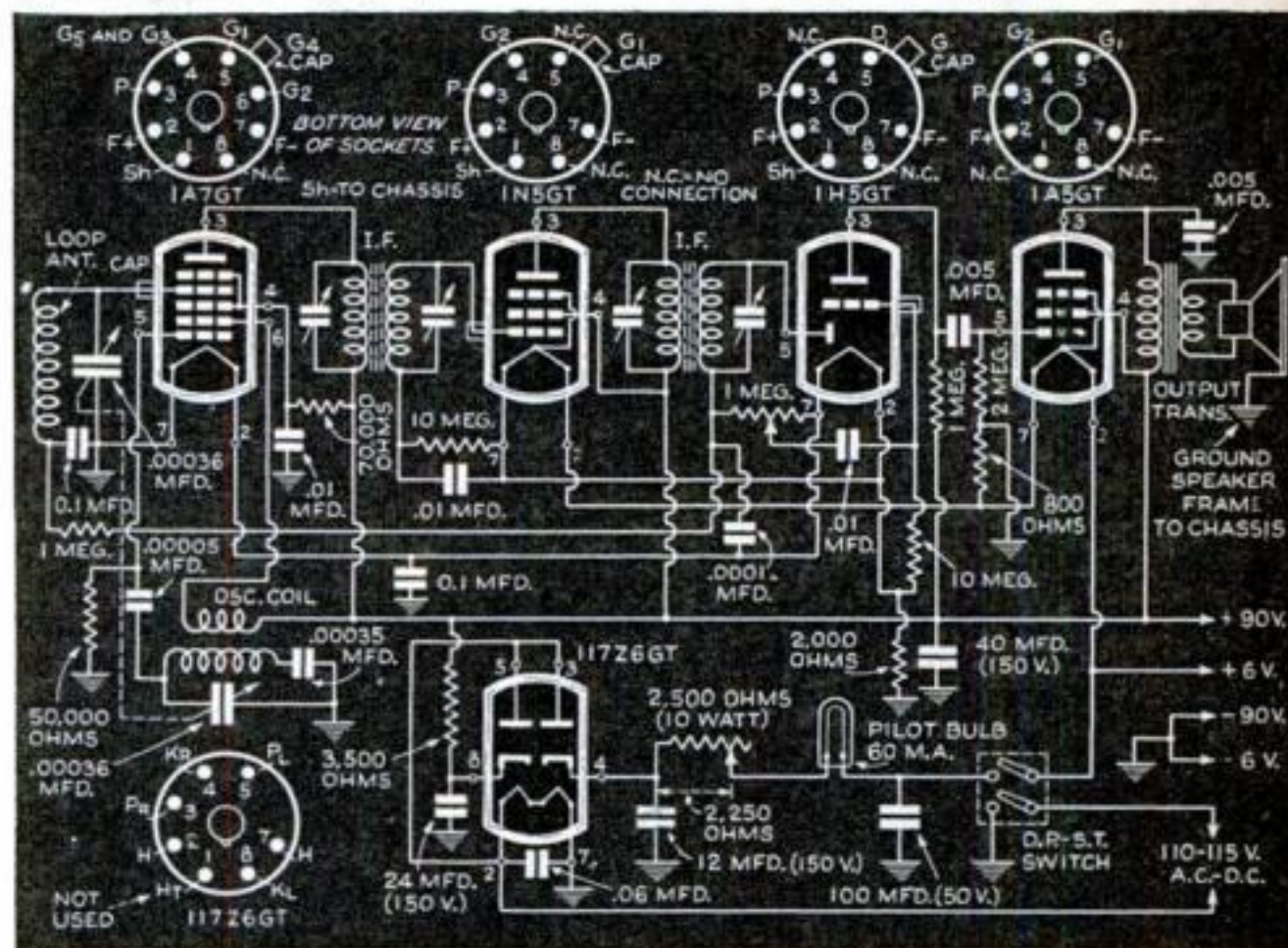
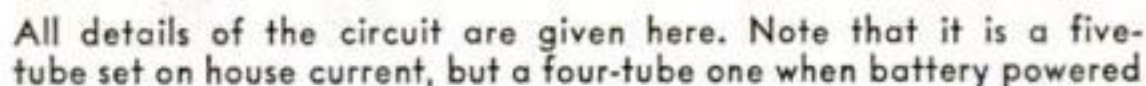
Oscillator coil, 455 kc.  
Padding condenser,  
.00035 mfd.

Tuning condenser, 2 gang, .00036 mfd.

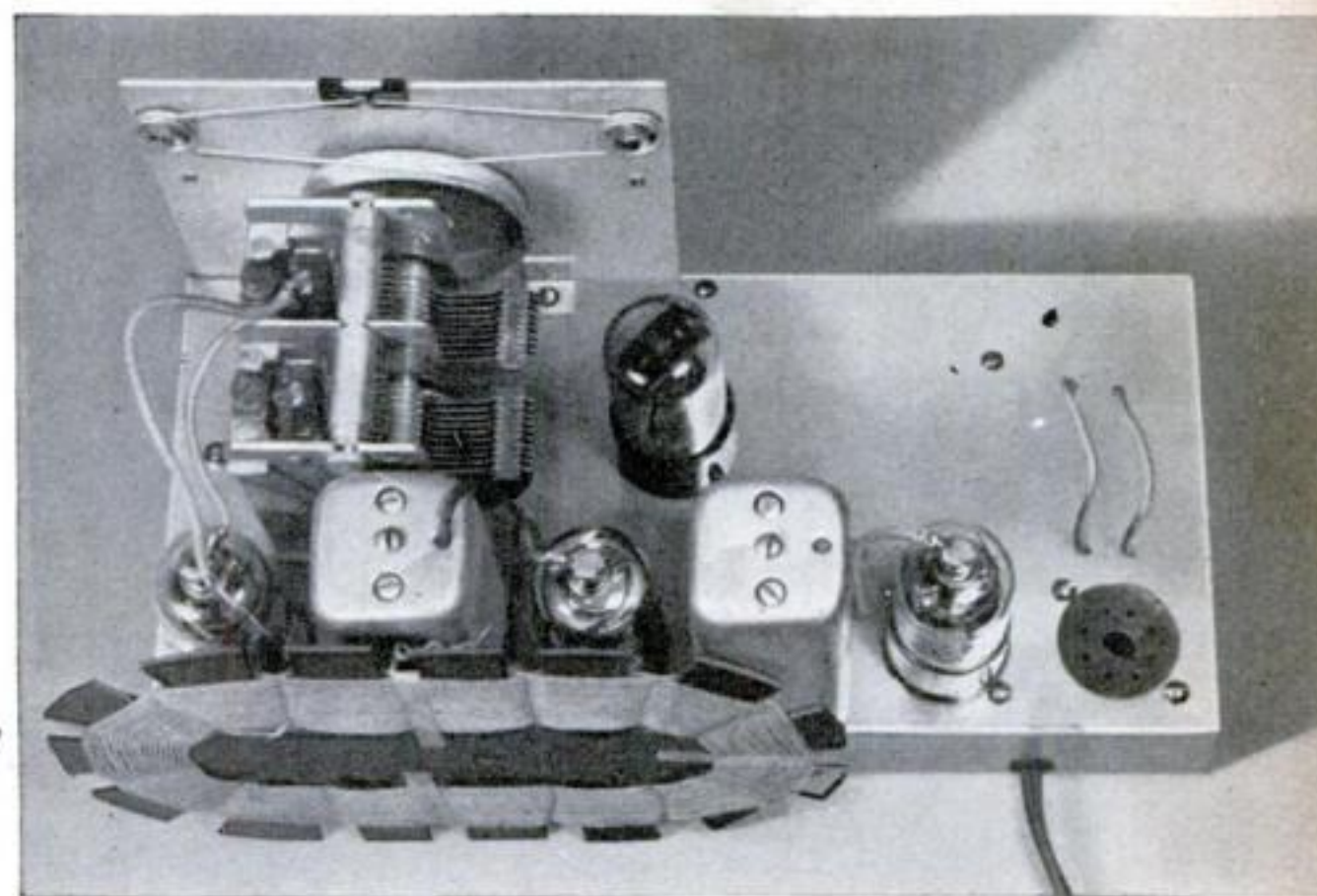
P. M. speaker.

Universal output transformer.

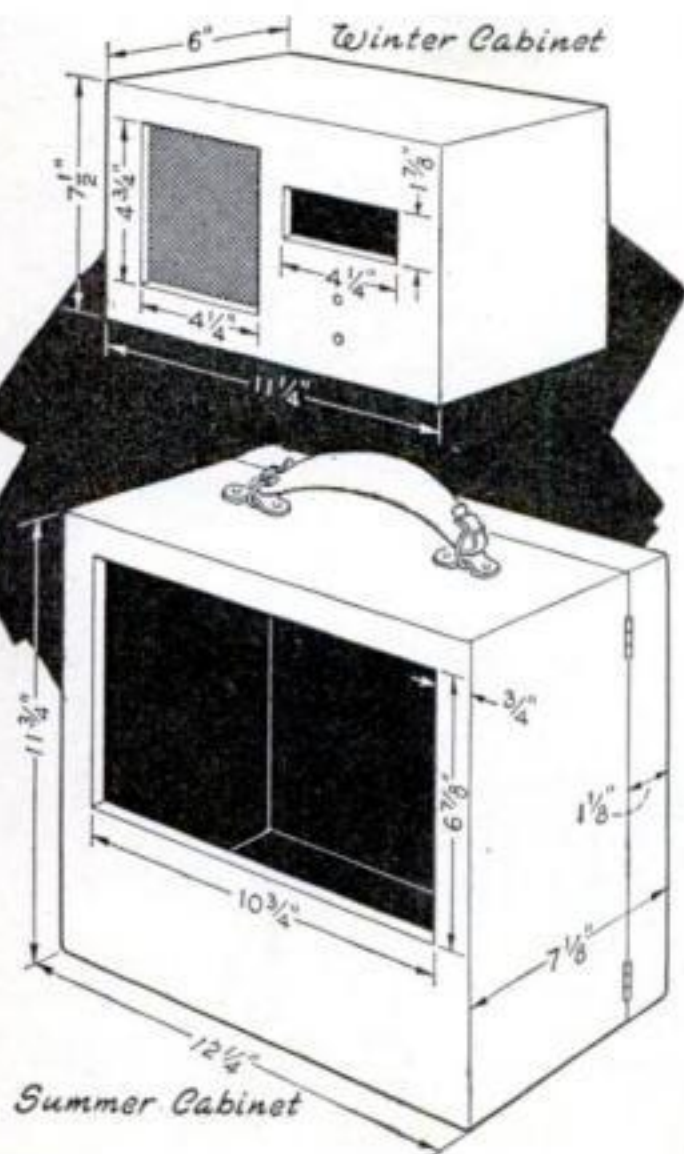
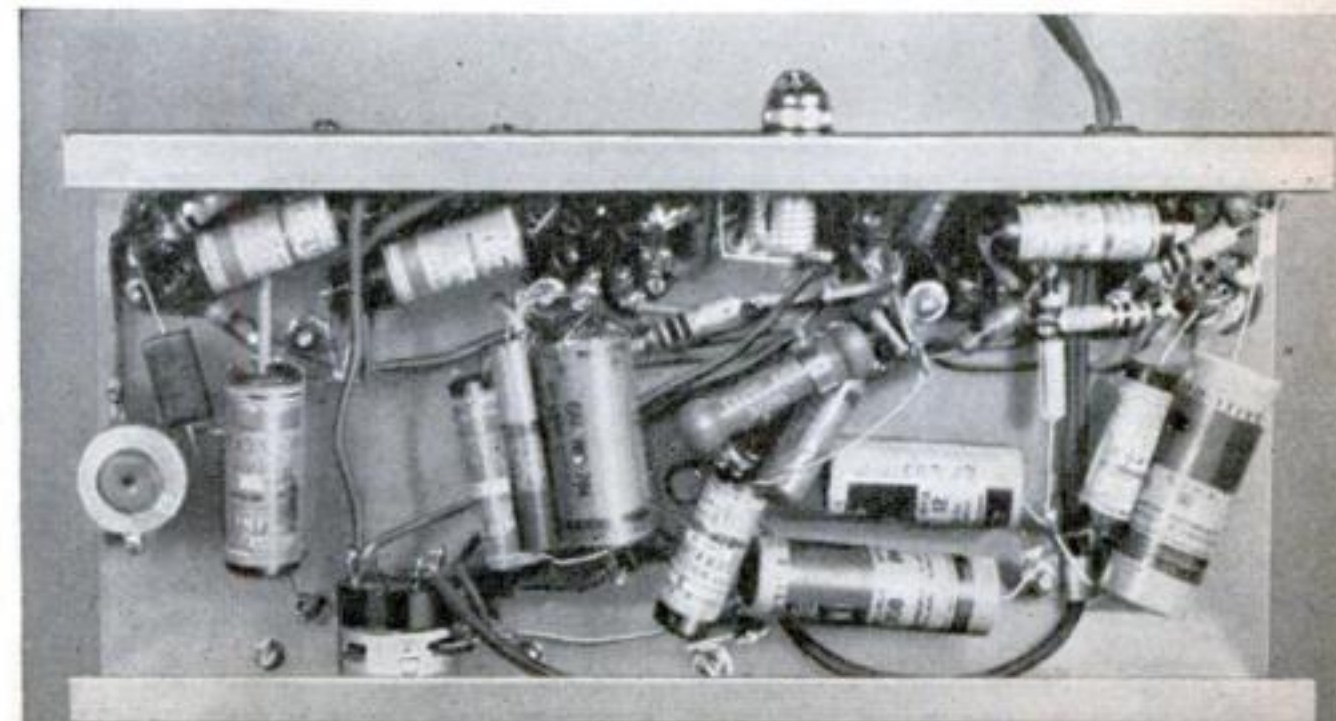
Speaker plug, battery cable, wafer socket, power cord, octal sockets, loop antenna, tubes, switch.



How the parts are arranged on top of the chassis. The grouping allows plenty of space for the loudspeaker mounted on the front panel



Use extreme care when soldering connections below the chassis





# PHOTOGRAPHY

A detailed black and white photograph showing a close-up of a locomotive's wheel and axle assembly. The image focuses on the mechanical components, including the spokes of the wheel, the axle, and the cotter pin mechanism used for securing the axle. The lighting highlights the textures and metallic surfaces of the parts.

"Cotter-Pin Locomotive"



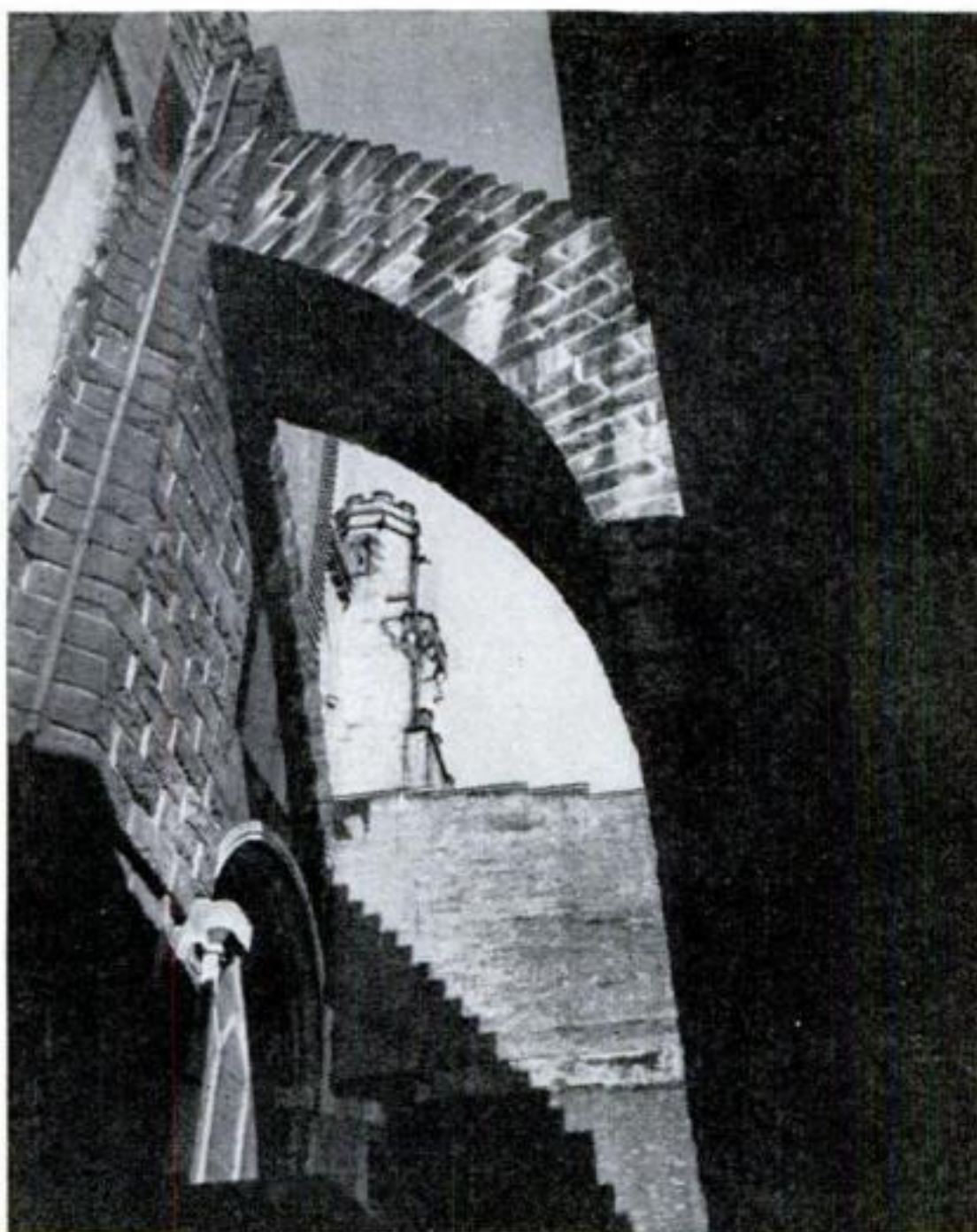
# "Pictures While I Walk"

*Popular Science Interviews  
Photographer Harold Harvey*

**H**AROLD HARVEY has built himself a highly satisfactory life on three careers and a hobby.

He began as an artist and illustrator, became one of the country's best-known commercial photographers, and turned from that to an even more brilliant success in photographic research; his best-known accomplishment thus far being the Panthermic 777 film developer, presented commercially three years ago. The hobby, however, has remained constant. Harvey has been taking photographs for thirty years, and although he never has time for commercial assignments any more, he hasn't stopped making pictures.

Every day of decent weather, the year around, Harvey emerges from his laboratory-apartment in uptown New York and



"Impressive Building Pattern"

conscientiously roves the section for exercise and fresh air. Invariably he drops a camera or two into his capacious pockets. The walk usually lasts an hour, and Harvey may take five pictures or five rolls. Most of these will be made for purely technical reasons—to check practical results against lab findings, or the cutting quality of a new lens. But Harvey's approach to photography is not altogether a matter of science—



"Amusing Contrast"



"It Piles Up"



he looks for humor, human interest, and pictorial quality as well.

And what does this photographic scientist shoot when he takes one of his camera walks? Well, take an imaginary stroll with him, looking over rough prints in his file and asking the simple question, "Why did you take that?" Here are the answers which explain why he felt impelled to make the various pictures that accompany this story.

*Cotter-Pin Locomotive:* "That's the sort of thing we were doing ten years ago. Just an old locomotive over in the yards, but it made a composition. The texture is good—and to tell the truth, it fascinated me to see that locomotive wheels have cotter pins, too."

*Impressive Building Pattern:* "The great Cathedral of St. John the Divine has endless photographic possibilities. I love to study its architectural details. This is simply an impressive building pattern."

*Amusing Contrast:* "That was an amusing contrast—a pretty girl and the grinning face of Pan—sort of a Pan and Superpan."

*It Piles Up:* "That's just an ornament over at Columbia University. It piles up—makes a nice composition."

*Small-Town Street:* "That walk was in a town in West Virginia where I wandered last summer. The sleeping dog, the old man sitting there—they just added up to a perfect picture of a quiet, hot day on a small-town street."

*Resolution of Detail:* "That's a test shot I make every time I go by it. I find it useful as a gauge subject for negative graininess—the lines in the pillars won't show if the grain is just a bit too coarse."

Like many another topnotcher in pho-



Harvey shoots skyward at a cathedral buttress

tography, Harvey began his training as an artist. Baltimore was his home town, and he studied art there, at the Pennsylvania Academy in Philadelphia, then in Paris—about eight years in all. He began using a camera to make records of street scenes and architectural details.

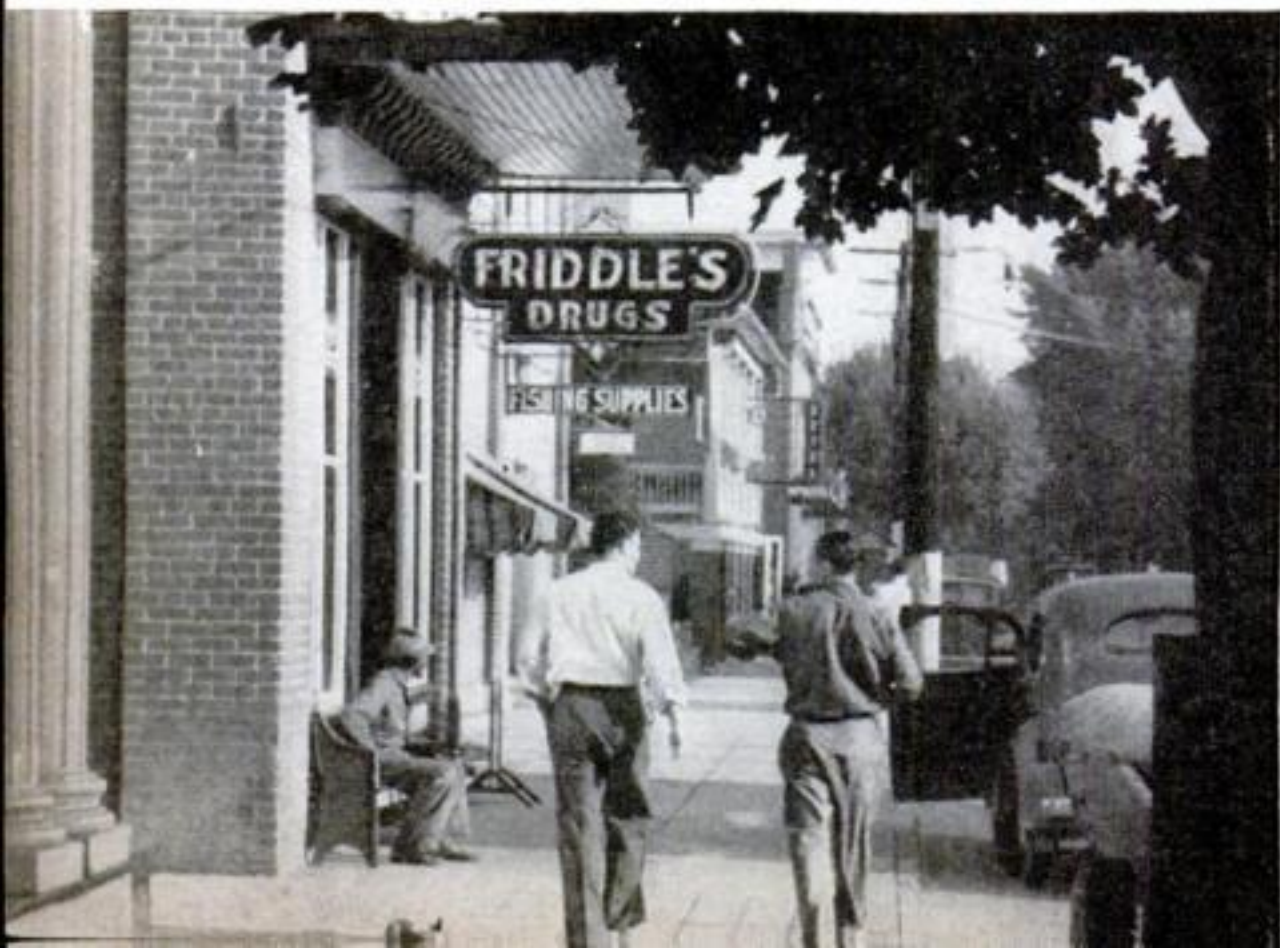
Gradually his interest in photography, both as an art medium and a science, altered his earlier plans. By 1930 he was back in

New York, a star photographer in the advertising field. He was retained on the Chesterfield account for three years, and is said to have been the first man to use a miniature camera (35-mm. film size) successfully for national ad pictures. His tiny negatives produced photos which were blown up to billboard size all over the country.

Harvey wasn't especially happy as a commercial photographer, but he made enough money at it to finance his first experiments in the complex chemistry and physics of photography. He had some training in chemistry, but there was a lot to learn, and it was not until five years ago that he was able to put all his time into research.

Harvey swears by—not at—the miniature camera, and uses it for anything from landscapes or air views to microscope work. He uses four Leicas and two Contaxes, and that is not because he is a gadget-lover, either. Each camera is used with a specific lens, and Harvey will not interchange his lenses. He works to a degree of precision far beyond that wanted or needed by most photographers, and the very small tolerances provided by the camera manufacturers are much too big to suit him. Each of his tiny cameras has been carefully checked and adjusted, each lens and range finder registering with the precision of a fine microscope.

"Small-Town Street"



"Resolution of Detail"





# Try Type for Movie Titles



For low-cost titles, use positive film. Tonal values are reversed when the film is developed

**G**OOD taste is the essence of titling amateur movies successfully. Titles must be planned and executed carefully if the final film is to present a workmanlike appearance approaching the professional. A small printing press, the cost of which is comparatively little, provides one of the best methods of making titles.

For white letters on black backgrounds, use positive film and print the titles in black on white cards having a rough or matte surface. You can develop the film yourself very easily.

If, however, you wish to use reversal film, don't try white printer's ink on black paper—the letters will not be clean cut. Instead, print with colorless varnish, then dust the title with silver or white powder while it is still tacky. Another method is to print black letters on transparent cellulose tissue, and use the tissue as a negative to make a photographic print. If photographs or magazine illustrations are to be used as backgrounds, reversal film is required, of course.

Whenever possible choose a type font for the opening title that helps to convey the idea expressed. Several examples are given at the right. Special fonts can often be borrowed from a local printer, or may be purchased secondhand for very little.

Most small commercial titlers for 16-mm. movies permit photographing a card of the size shown at the bottom of this page. When such a titler is used, the letters of the lead title should seldom be

more than 24-point size (approximately 5/16" high). Explanatory titles throughout a film can be set in 14-point type (approximately 1/8") or a little larger. Choose a font of straight, clear type for these titles. Fancy types have no place in the average film except at the beginning and possibly at the end.—JOHN H. WOOD.

**MEXICAN  
ADVENTURE**

Neuland

**WINTER'S  
WONDERS**

Phenix

**Broadway  
Nights**

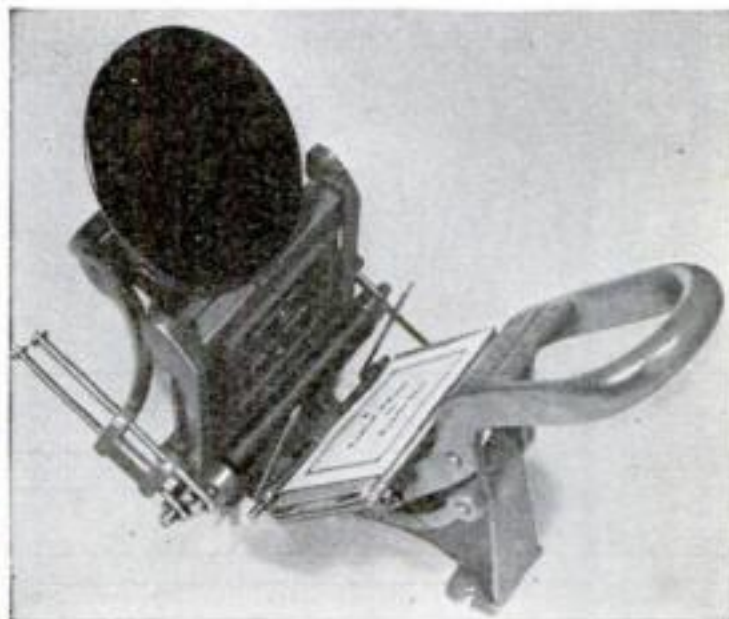
Barnum

*Fifth Avenue  
in the Spring*

Bernhard Cursive Bold



The title at left may be used in any of the small commercial titlers. Below, a hand press suitable for printing titles





# Chaplin of Still Pictures

By JOHN H. WALKER

**N**O PROBLEM in photography is tougher than that of turning out funny pictures consistently.

Lejaren a Hiller, one of the greatest commercial photographic illustrators, has made something of a specialty of humor, achieving brilliant results in a field that most commercial men avoid or neglect. He has two guiding principles for the job:

1. Don't tackle a humorous photographic subject unless you are really in the mood for it—feeling well and reasonably happy.

2. Unless a ready-made situation or subject presents itself, you are apt to get the best results by using yourself as a model.

"You can't force humor," Hiller explains. "It's got to be spontaneous. Humor in photographs usually must involve human beings, and that's where you run into trouble with models. It's hard for them to be spon-



COURTESY OF AGFA ANSCO

Lejaren a Hiller, master of the lens, is his own model in his most humorous shots. He made this one originally for a Christmas card

taneous under the strong lights, with a lot of make-up on.

"The average model is a clothes rack—no expression at all. And 'acting' isn't much good. Nine times out of ten it looks phony in a still picture. You have to try to make the model actually feel the emotion you want to show—or something close to it.

"Sometimes I have to deliberately annoy a model, to get the proper angry expression.

## WIN \$25

with your

## FUNNIEST PHOTO

Do you have a funny photo that starts the chuckles rolling among your friends? You probably do, and that's why we are offering a prize of \$25 for the funniest photograph we receive from our readers before January 15, 1941. Dig into your file now . . . bring out your most laugh-provoking photo . . . and mail it to Photo Editor, Popular Science, 353 Fourth Avenue, New York, N. Y.

Any subject, so long as it's funny, will fill the bill. Limit your print size to 8" by 10". Single-weight, glossy paper preferred. No photos returned. Editors' decision is final. In case of a tie, duplicate prizes will be awarded.



Or, if you want him to have a quizzical look, you can mumble instructions that he won't quite understand, and then catch the picture when he turns and strains his ears and wrinkles up his brow, trying to figure out what that dope over at the camera is saying."

In other words, when you set up and direct that kind of picture, you have to be an actor yourself. And Hiller has found that some effects can be obtained only when you step into the picture and become your own model. In a big studio, of course, he can line up his picture and give the signal for an assistant to make the exposure. An amateur photographer can do the trick with a long extension cable release; a little practice will enable him to conceal the cable and keep it out of camera range.

And what are the principles for self-modeling? In the first place, Hiller reiterates that you have to feel like doing this at the time. Second, try to do as little pretending as possible. If the picture is to show you drinking from a cup, have some water or tea and really drink it. (Naturally, this technique is conditioned by the length of the camera exposure, unless you are taking movies.)

Third, use the technique of exaggeration, but use it with care. If you want to look annoyed or startled, try to feel that way, then pour on the expression a bit more. (Americans cultivate the polite habit of concealing emotion, and most of us develop better poker faces than we realize.)

The lighting of your picture can make a tremendous difference, and Hiller says it seems to follow a law of gravity—down lighting tends to direct the mood of the picture down, to make it softer and quieter in feeling, while bright lighting from below pushes the picture up, gives it a mood of greater brilliance and lift.

How much the photographer's spontaneous mood can have to do with a picture is well shown by one of Hiller's latest and greatest humorous photos. It



COURTESY OF GENERAL ELECTRIC

Skillfully chosen accessories help a lot, as in this case where Hiller enacts the part of a disconsolate horn player

Although his face is actually rather mild and dignified, he has learned how to contort it into a variety of "mugs"

COURTESY OF SPUD CIGARETTES





represents an old-style stage magician having his troubles with card tricks and egg tricks. This picture is being widely used as an advertisement and is regarded by expert photographers as a classic of its type.

The story behind it is that Hiller never made that picture as a commercial job. He knocked it off for his own amusement, planning and modeling the pose himself, to be used as a family Christmas card. Friends in the advertising business saw the card and fell in love with the picture.

"A man making faces is one of the oldest and surest bits of humor in the world," Hiller explains, "and it helps a lot if you have a funny mug to begin with."

His own "mug" isn't naturally funny—you'd describe him rather as mild and dignified. But it is highly mobile. He can twist, wrinkle, and grin. His iron-gray hair can be plastered down for effect, and he is gifted with a moderately long nose which a little make-up and a skillfully planned high light can transform into a regular W. C. Fields-Jimmy Durante schnozzola.

Just when Hiller began making funny faces on a serious scale he can't remember. He suspects it all dates back to a brief, stage-struck experience years ago.

Hiller's family originally came from southern France. He was born in Milwaukee (nearly sixty years ago, although he doesn't look it). He started out to be an artist, and still paints in the backgrounds of the elaborate sets against which many of his advertising illustrations are shot.

Early in the game, however, he became fascinated with the possibilities of the camera and helped pioneer the modern art of illustrative photography. He has been rated a top-notch photographer for more than thirty years, and is credited with being the first man to use the camera successfully in illustrating magazine fiction.

He is vice-president of the Underwood &



COURTESY OF AMERICAN OIL COMPANY

"A man making faces," Hiller says, "is one of the oldest and surest bits of humor." In this example the mood is helped by down lighting

Underwood agency, and works in a crowded, barnlike studio not unlike a movie set, near the East River in midtown New York.

Hiller claims every man should try to have two jobs—to carry a spare profession, you might say, in case one goes flat. His own extra job is writing.

Some of his current photographic jobs are so complex that he considers them problems in applied science rather than photography. On a recent job, for example, he had to show a native riding a speeding surfboard on the crest of a blue wave. Three chemical companies were consulted in an effort to develop something that would look like white sea foam but stand up long enough to be photographed under power lights. In the end Hiller solved the problem himself by mixing salt with fire-extinguisher foam; the foam itself disappeared, but left the outer coating of salt in place. It was still there, looking fine, when they knocked the set down a week later.



# Taking the Popular Science Cover



MIDDAY sunlight and three shrewdly placed blue flash lamps gave William W. Morris, POPULAR SCIENCE staff photographer, just the illumination he needed for the full-color picture of the Curtiss dive bomber SBC-4 reproduced on this month's cover. He had to stretch full length on the ground and shoot with a one-arm grip on his 4" by 5" Speed Graphic.

The photograph of this training dive bomber was taken at the Floyd Bennett Field Naval Reserve Base, Brooklyn, N. Y. The exposure was made on daylight Kodachrome—f/11 at 1/25 second. An Abbey flash gun, with two tandems or photoflash extensions, was used. There was one bulb at the camera to illuminate underneath the cowling. Another was held by Editor Charles McLendon so as to throw light on the yellow strip under the upper wing and on the face of the pilot, Lieutenant-Commander Don F. Smith, U.S.N. (in circle). The third lamp was clamped to a camera case where it would lighten the underside of the fuselage. Twelve



shots were made from various angles, and a crew of Navy mechanics shifted the plane around as required for the best lighting and background effects.

Photographer Morris has had wide experience in such work. He was in charge of photography at the New York World's Fair, 1939 and 1940, and was formerly chief publicity photographer, United States Navy, where he served from 1915 to 1923.

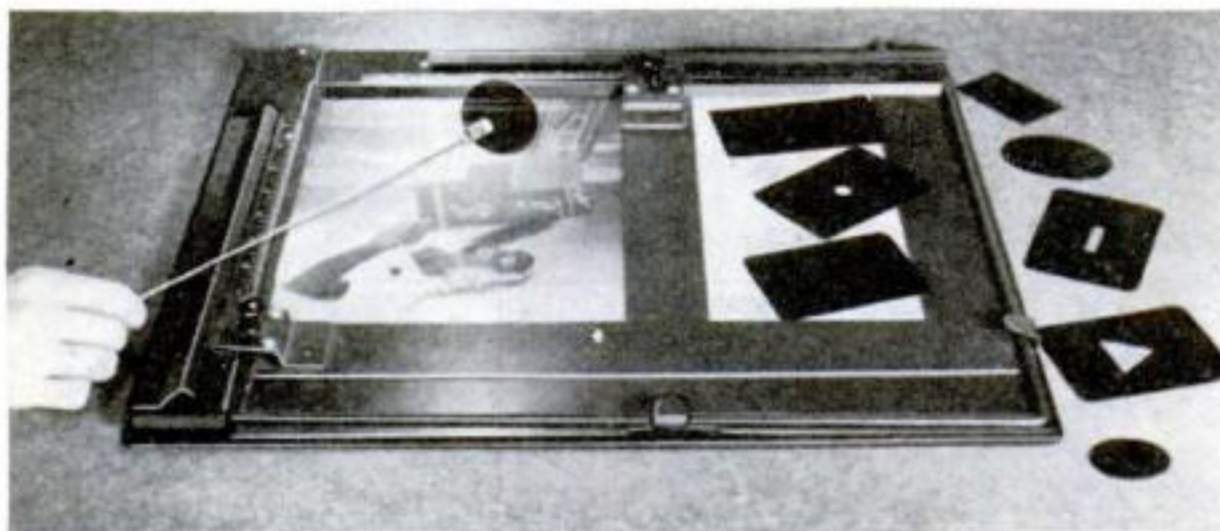




**EXPOSURE-METER BRACKET.** Using an exposure meter and a camera at the same time is made easy by a metal bracket which is attached to the tripod socket of the camera and holds the exposure meter securely in position.

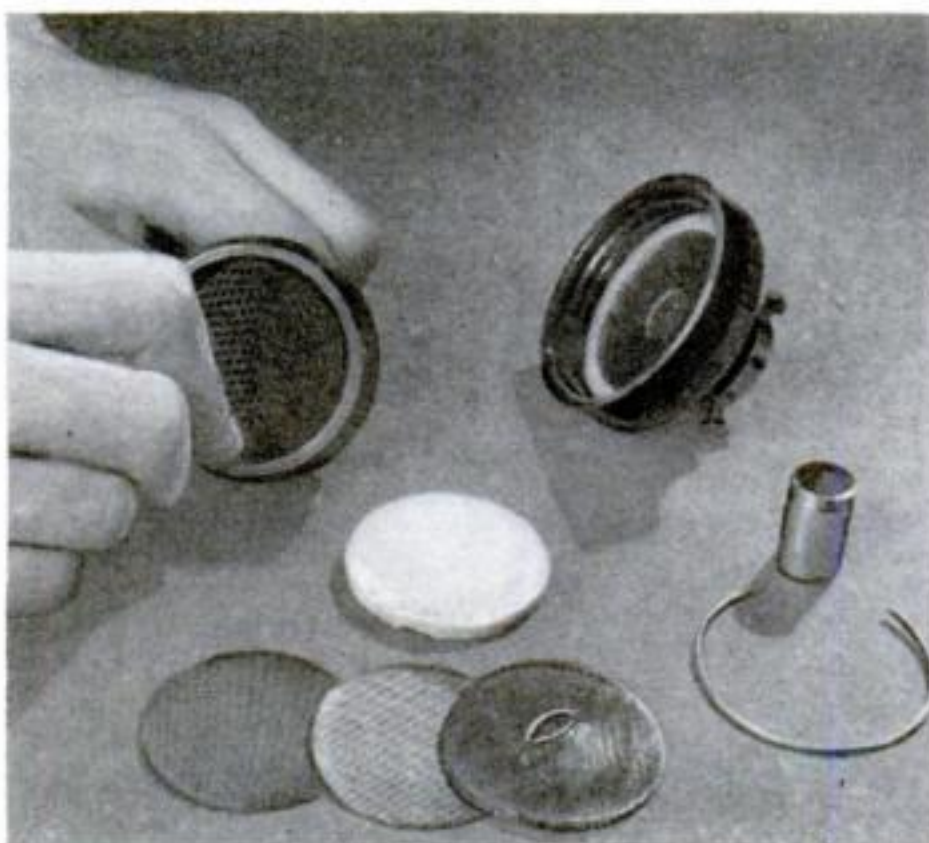
# DEVICES FOR

**FRAMES KEEP PICTURES CLEAN.** Fitted with windows of transparent cellulose acetate, the frames shown below protect photographs mounted in an album. Backs of the frames are gummed for attaching to album pages. Made in several sizes, they may also be used for preserving stamps, newspaper clippings, and other display material.



**ENLARGER DODGER.** Here is a versatile dodger for the amateur who does his own enlarging. A wire handle with a small clamp on its tip holds any one of nine pieces of red celluloid which cover a wide range of sizes and shapes, including circles, ellipses, oblongs, and squares. Several of the pieces have holes in their centers for "burning in."

**WATER FILTER.** Made specially for use in the darkroom, the filtering device seen at the right can be attached to any faucet. Its parts, shown in the first photograph, include several screens and a filter disk made of cellulose fiber. When the filter disk becomes foul as the result of use, it can be cleaned by placing it in a bottle of clear water and shaking it vigorously, then pouring the water off with a strainer.





# CAMERA USERS

## CORNER CUTTER

With this tool, the amateur can mount a photograph quickly in an album without using gummed corners or paste. The print is placed in the desired position on the album page and a corner is inserted in a slot in the cutter. By pressing the handle, the two slits are cut in the page



**TRAY CLEANER.** Stains are removed from developing trays, glass printing frames, and other darkroom equipment by a cleaning preparation in paste form. The cleaner is applied with a damp cloth, after which the article is rinsed off and allowed to dry



**PANCHROMATIC MAKE-UP KIT.** Specially created to reduce the need for retouching in black-and-white portraits, panchromatic cosmetics are available in handy stick form in a kit containing five shades of complexion foundation, three shades of powder, lip rouge, eyebrow pencil, and eye shadow

## TRIPOD AND NECK POD

are combined in the accessory shown at the right. The camera is screwed onto the end of a rod which can be either supported on three legs as a table-top tripod, as seen in the first photograph, or hung around the neck by the strap attached to its lower end. When fully extended, the tripod is eighteen inches long, but it folds into a compact bundle measuring about ten inches over all. The tripod head is adjustable. For convenience, the strap can be removed by taking out the knurled screw that holds it in place. When used as a neck pod, the device gives a three-way camera-steadying effect







Two pictures taken from the same place with the same camera, one with the complete lens, the other (right-hand view) with the front lens cell alone

# Five Lenses in One

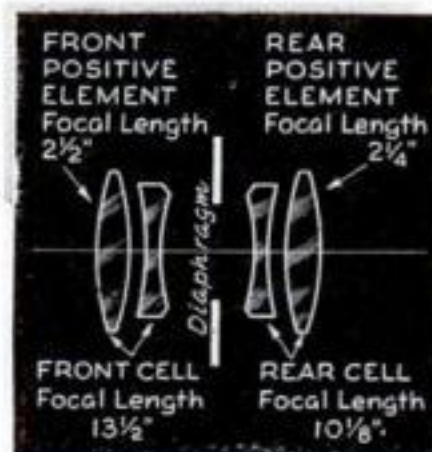
BY ARTHUR TRAUFFER

IF YOU can pick up a secondhand anastigmat lens of the symmetrical, four-element, air-spaced type\* or salvage one from some old camera, you can have a lot of fun experimenting with it. Mounted in a camera with ground glass and double or triple extension bellows, it will serve as a makeshift convertible lens of five different focal lengths.

Completely assembled, as intended by the manufacturer, the lens is suitable for regular work. The front and rear cells, used separately, provide two different long-focus lenses that give large images of distant objects. In addition, the front and the rear positive elements—that is, the convex elements—form separate short-focus lenses for making greatly enlarged copies (macrophotography). Thus there are one ordinary, two long-focus, and two short-focus lenses.

It goes without saying that a single cell or a single element is subject to optical aberrations and must be stopped down sharply. It will also be found that the speed of either cell, when used separately, will be considerably slower than the speed of the complete lens. All the illustrations were

Because the four lens elements can be used separately or grouped, they act in a pinch as one ordinary, two long-focus, and two short-focus lenses



Magnified detail of a postage stamp obtained by using only the rear positive lens element

\*A well-known lens of this kind is the old Kodak Anastigmat (Eastman) series f/7.7 and f/6.3, which is no longer made for hand Kodaks. Others are: Cooke Aviar, Goerz Apochromat Artar, Goerz Celor, Goerz Dogmar, Goerz Gotar, Goerz Syntor, Graf Anastigmat, Gundlach (Unofocal type), Steinhell (Unofocal type), and Luxar.

made from a lens removed from an old f/7.7 post-card size folding Kodak purchased secondhand for a few dollars. The focal length of the complete lens is 6 1/2", and the parts are shown in a diagram above.



# Photographic Paper Box

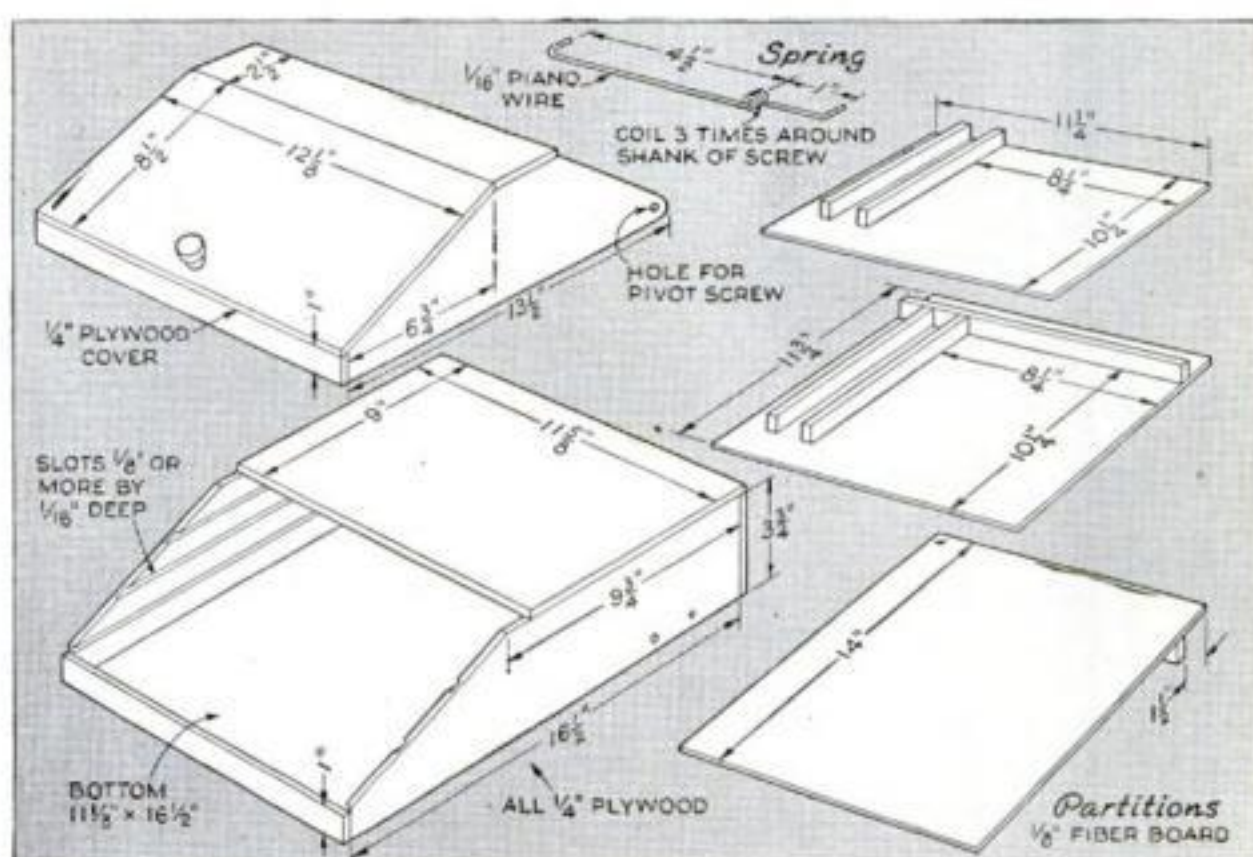
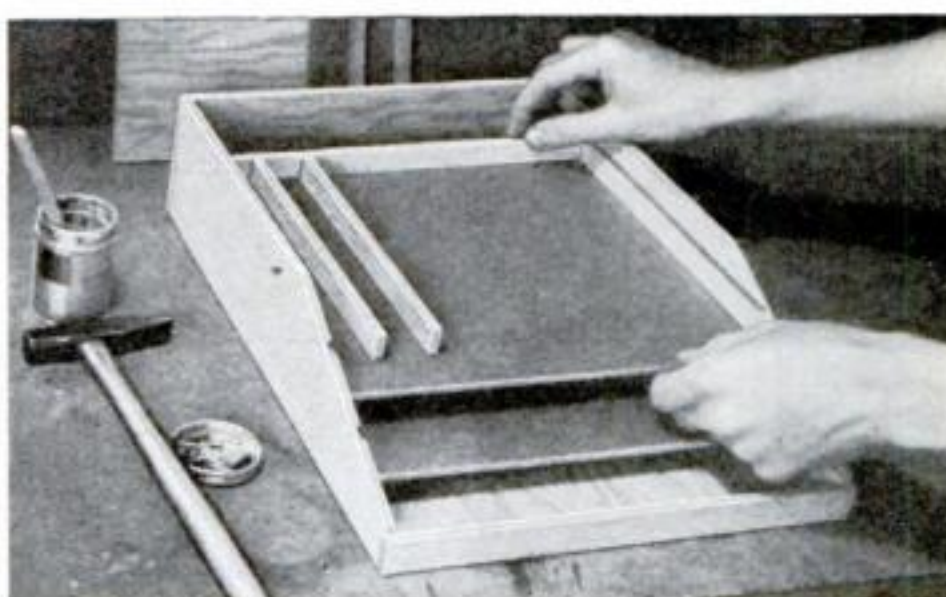
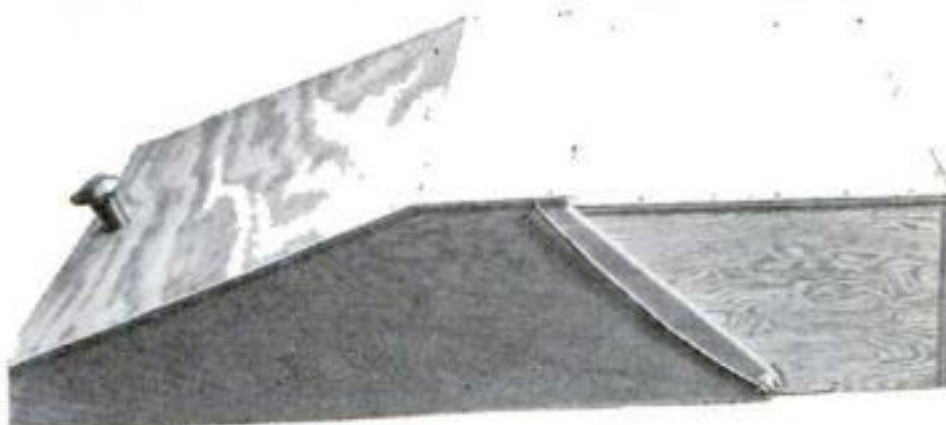
**P**HOTOGRAPHERS can save time in enlarging by keeping the projection paper in a light-tight, self-closing box or desk like the one illustrated. This makes it unnecessary to open several envelopes each time a sheet is needed. The box has two compartments each for 8" by 10" and 11" by 14" paper, as well as places for test strips. The design is such that the box may be used vertically or even screwed to the wall if bench space is limited in the darkroom.

All the principal parts are cut from  $\frac{1}{4}$ " plywood. Groove the sidepieces to receive the partitions, which are  $\frac{1}{8}$ " fiber or pressed-wood board. Glue and nails are used to join the pieces together tightly enough to be lightproof. Block off the partitions with narrow strips of wood so that each compartment is slightly oversize for the paper it is to contain. The extra space is used for the test strips.

Fit the cover over the box and drill a small hole on each side in the lower back corner. Small roundhead screws pass through these holes into the box and act as pivots for the cover. To make the cover self-closing, a spring is used on each side. This is shaped from  $\frac{1}{16}$ " piano wire by coiling it three times around the shank of the pivot screw and bending the ends at a right angle to fit into two holes, one drilled into the cover, the other into the box.

As the grain in most plywood is attractive in itself, the only finish required on the outside is shellac and varnish. The accompanying photos were taken before the interior was painted, but as a precaution against any leakage of light around the cover it is advisable to give the inside a coat of flat black. Of course, the outside of the box may also be painted, if desired. Choose a serviceable color that will not reveal finger marks.

—FRANK MCCARTY.





## How to Get a Dog to Pose Alertly

FOR taking more alert and animated pictures of your pet dog, this electric "birdie" is a great help. It consists of a doorbell screwed on a board that can be mounted on a folding lamp stand. A tin-foil lure is hung on the gong hammer by means of a loose wire loop. Properly adjusted, the lure will climb up the vibrating hammer when the bell is rung, and then slide down when it is stopped. A buzzing sound instead of a ring can be obtained by cutting a notch in the rim of the gong and turning it so the hammer vibrates without striking the metal. A flash gun, connected to the bell by means of an extension cord, serves as a compact battery-and-switch unit. Short buzzes or rings, sparingly used to maintain curiosity, get the best attention-holding results.—J. M.



The dog's attention is held by short rings or buzzes and by a vibrating tin-foil lure



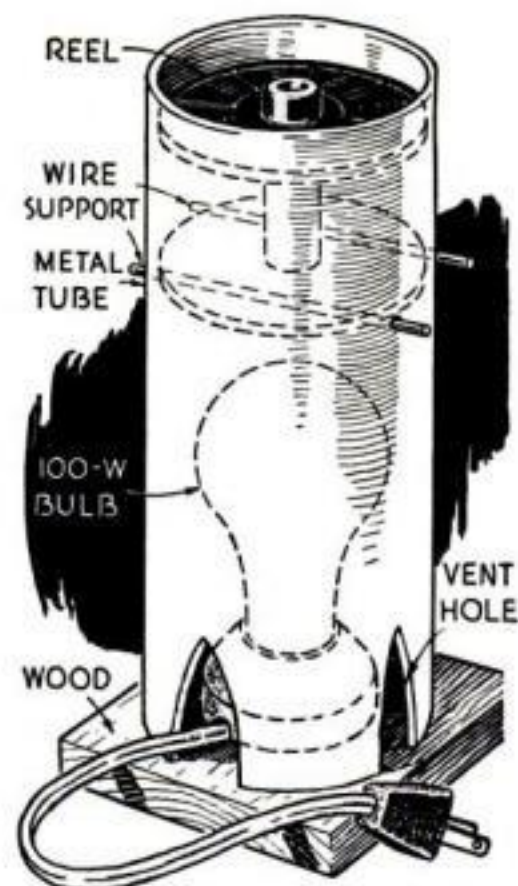
## Simple Accounting System Keeps Track of Cut Film

YOU will not run out of cut negatives unknowingly if you use the simple accounting system illustrated above. Each time you take one or more films from the box, subtract the number from the old balance and then mark the remainder on the margin of the box cover.

## Wet Reel from a Roll-Film Tank Dries Quickly over an Electric Lamp

A SIMPLY made tank-reel drier will greatly increase the usefulness of your roll-film tank. You often want to start developing a second film while waiting for the first one to dry, yet cannot do so because it is impossible to thread the film if the reel is the least bit moist. The device shown is a sheet-metal or heavy cardboard tube of sufficient size to permit the reel to slide down inside. To prevent the reel from slipping down too far, a pair of wires are inserted as shown, or any suitable form of support may be used. At the bottom of the tube, mounted on the base-board, is a large electric lamp.

The empty film-tank reel will dry very quickly provided you shake as much water as possible from it before you place it in the tube.—RUSSELL J. HUNT.





# New Delta 10" Saw Is the *Perfect* Tool

Designed after 7 years of study, research and experiment—7 years of analyzing the defects in existing designs—of testing, re-testing—7 years of making model after model—this new Delta 10" Tilting Arbor Saw is as near the perfect tool as modern engineering can make it. Thousands of users agree that it offers numerous exclusive advantages and an operating efficiency never before attained!

## Here Are Some of the Features of This Remarkable Tilting Arbor Saw

Generous sized table 20" x 27" (with wings, 27" x 36"). Handles work up to 50" wide and 3 1/8" thick. Powerful, fully enclosed motor; highly efficient Texrope drive; rigid, scientifically designed housing; perfected raising, lowering and tilting mechanism; patented, double-face, double-lock rip gauge; exclusive precision auto-set miter gauge; patented ripping extensions; "sealed-for-life" ball bearings and many other features.

## Send for Latest Delta Catalog

A complete guide book to power tools which not only lists the complete line of Delta "Quality" wood and metal working tools—but shows you the important points to look for in all power tools. (Also send for Project Book No. 7 crowded with new projects, including working drawings, photographs and full instructions.)

# DELTA MFG. CO.

600-634 EAST VIENNA AVENUE  
MILWAUKEE, WISCONSIN



## Inside Secrets of Delta Quality "PRECISION GRINDING"

All arbors, spindles, bearing seats, etc. on Delta machines where accuracy to close limits is important, are ground to size. Turning to size is "good enough" for many manufacturers

but not for Delta machines! Precision grinding to size, after turning, is an extra operation. It costs more money—and you can't see it as you can see nickel plating on the outside of the machine. But in a bearing or bearing seats, it provides a fit that is "all over" instead of only on a comparatively few high spots. This means that ball bearings do not become loose in service. Precision grinding produces a *closer* fit, to more exacting tolerances, which means that fits are uniformly good, and that true interchangeability is obtained.

The extra accuracy obtained by precision grinding may be visualized when it is realized that the *ordinary* variation or tolerance on Delta arbors and spindles is three-ten-thousandths of an inch, and in many instances this tolerance is held to one ten-thousandth.

Before you buy any light machine tool, make sure all parts that vitally affect the accuracy and life of your machine, are *precision ground* to size!

DELTA MANUFACTURING COMPANY (Dept. B141)  
600-634 E. Vienna Ave., Milwaukee, Wis.

Gentlemen: Send me the latest Delta Catalog listing the complete line of Delta Lathes, Circular Saws, Band Saws, Jointers, Scroll Saws, Shapers, Sanders and Drill Presses. ☐ I enclose 10c (stamps or coin) for which please send me the new Delta Project Book No. 7.

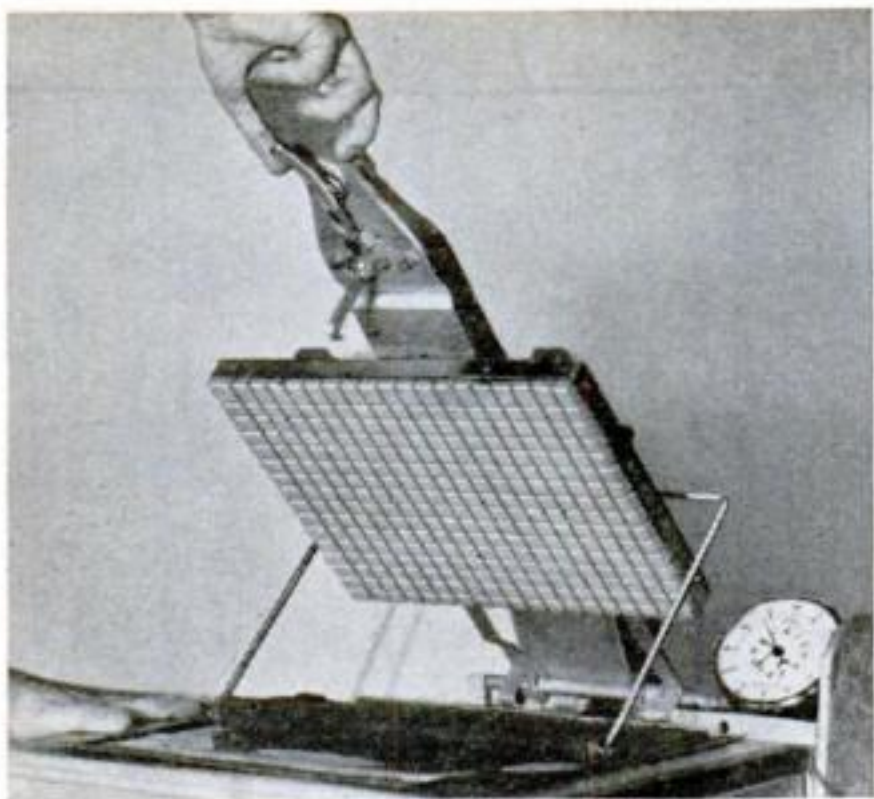
Name.....

Address.....

City.....State.....

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## Sponge Rubber Pad on Printer Furnishes Perfect Contact

DO YOU have trouble in pressing your photo prints in perfect contact against the negative in your printer? If so, remove the old padding from the printer head and replace it with a sheet of sponge rubber  $\frac{1}{4}$ " thick. Use casein glue because the heat from the printer lights might soften other adhesives, such as rubber cement. Use a steel brush or sandpaper to clean both surfaces and wipe off the dust before gluing. Leave the printer head under a weight overnight for the glue to set.

Rule  $\frac{1}{2}$ " squares on the rubber with  $\frac{1}{8}$ " spaces between them. With a sharp safety razor blade, cut along the  $\frac{1}{8}$ " lines between the squares and remove the  $\frac{1}{8}$ " strips. The spaces thus provided allow the squares to spread easily and make contact with the negative and mask when the printer head is depressed.—R. D. MURPHY.

## Removable Labels for Bottles



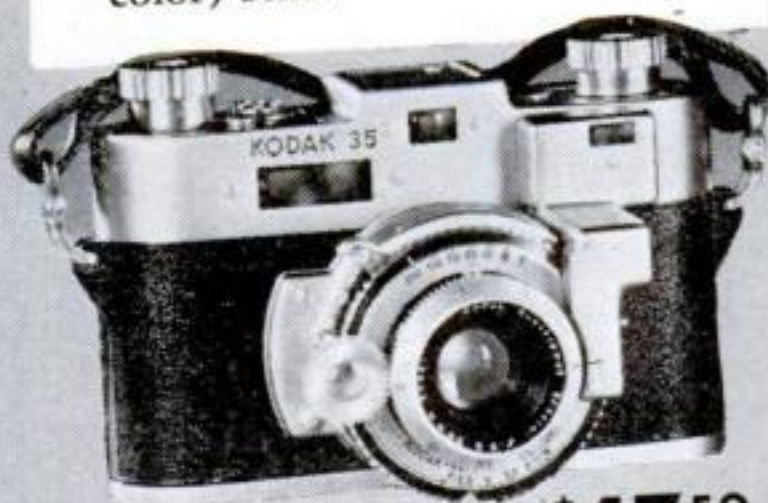
PHOTO chemical bottles are more easily labeled if the name or number of the formula is lettered on a square of white double-weight paper and fastened to the bottle or jug with a rubber band cut from an old inner tube. Such a label is easily read, and it can be removed when the bottle is to be washed. The date on which the formula was mixed can also be written on the label.

# Your KODAK

### KODAK 35

with Coupled Range Finder

All the Kodak 35 precision features—plus coupled range finder. Kodak Anastigmat Special  $f/3.5$  lens;  $1/200$ -second Kodamatic shutter. Modern photofinishing leads to black-and-white prints  $2\frac{3}{4} \times 4$  inches. Also takes Kodachrome (full-color) Film.



**\$47<sup>50</sup>**

### CINÉ-KODAK EIGHT Model 20

Gives you 20 to 30 black-and-white movie scenes—each as long as the average newsreel scene—on a roll of film costing \$2, *finished, ready to show*. Also loads with Kodachrome (full-color) Film.



**\$29<sup>50</sup>**

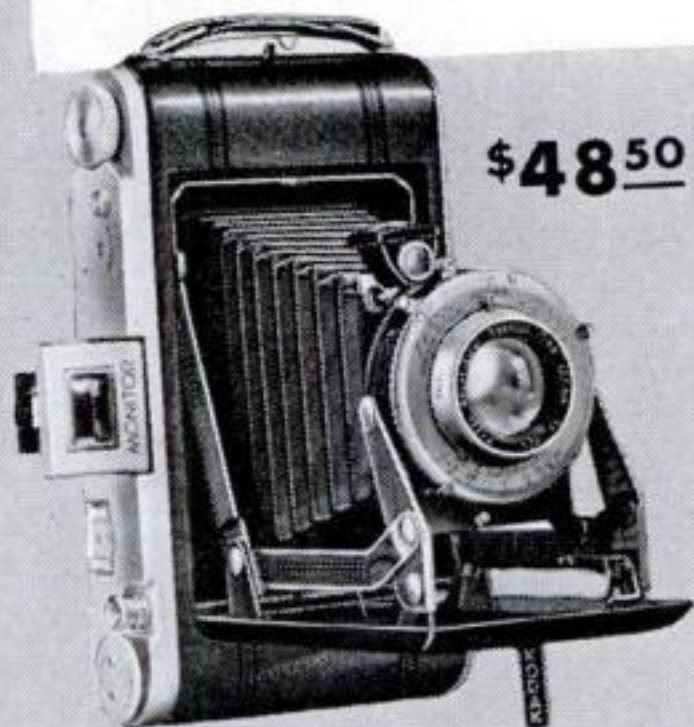


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## **KODAK MONITOR SIX-16**

(Special  $f/4.5$ ) Supermatic Shutter

One of the greatest cameras for  $2\frac{1}{2} \times 4\frac{1}{4}$ -inch pictures. Kodak Anastigmat Special  $f/4.5$  lens;  $1/400$ -second Supermatic shutter. Double-exposure prevention. Film-centering device. Exposure counter.



**\$48<sup>50</sup>**

## **KODAK VIGILANT SIX-16**

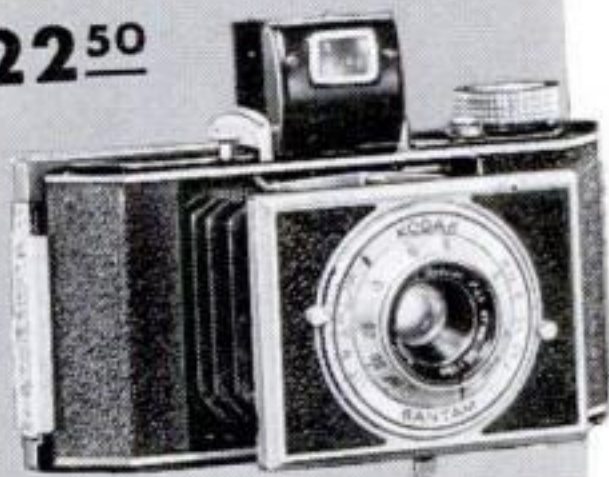
(Special  $f/4.5$ ) Supermatic Shutter

An instant hit—with self-erecting front, retracting body shutter release, two view finders. Precise Kodak Anastigmat  $f/4.5$  Special lens,  $1/400$ -second high-speed Supermatic shutter. Pictures,  $2\frac{1}{2} \times 4\frac{1}{4}$  inches.



**\$42<sup>50</sup>**

**\$22<sup>50</sup>**



## **KODAK BANTAM $f/4.5$**

Gives you the speed and precision of the Kodak Anastigmat Special  $f/4.5$  lens,  $1/200$ -second shutter. Modern photofinishing methods lead to black-and-white pictures  $2\frac{3}{4} \times 4$  inches. Also takes full-color Kodachrome Film.

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**\$1<sup>25</sup>**

No. 133H is similar to No. 233H, but has wood handle without accessories.  
No. 330H Accessory Pak (75c at dealers) contains extra Chuck, 3 Drills, Countersink and 5/32" Bit.

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make better mechanics

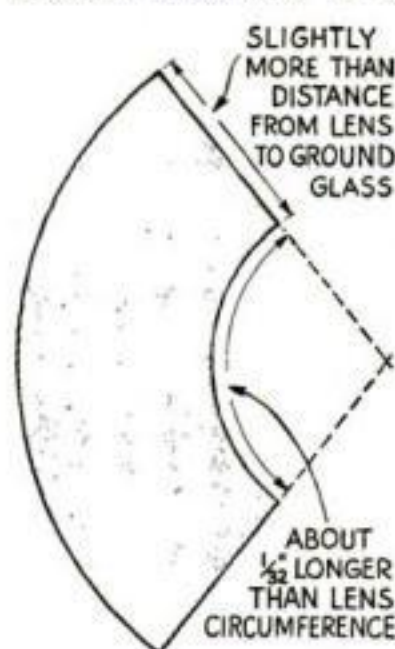
North Bros. Mfg. Co., Philadelphia, U.S.A.



## Easily Assembled Magnifier Aids Ground-Glass Focusing

ASSEMBLED in a few minutes, this magnifier aids in accurate ground-glass focusing. The upper and lower hoods are cut from an old inner tube, and the magnifying glass is from a cheap pocket magnifier.

Draw a paper pattern for the two hoods, which are identical, and cut the rubber to match. Fasten the edges of the cones with rubber cement. A reinforcing strip of inner



tube about 1/4" wide is then cemented to the inside of each of the seams.

The cones are finally cemented together at their small ends, and the magnifying glass is cemented in place. It can be made more secure by cementing a narrow strip of inner tube above and below it inside the two cones.  
—ROBERT SCOTT.

## Spilled Hypo Causes Injurious Dust

WHEN developing in the darkroom, always be careful not to splash any hypo solution on the floor. Hypo dust may result when the water evaporates, and cause spots on sensitized materials.





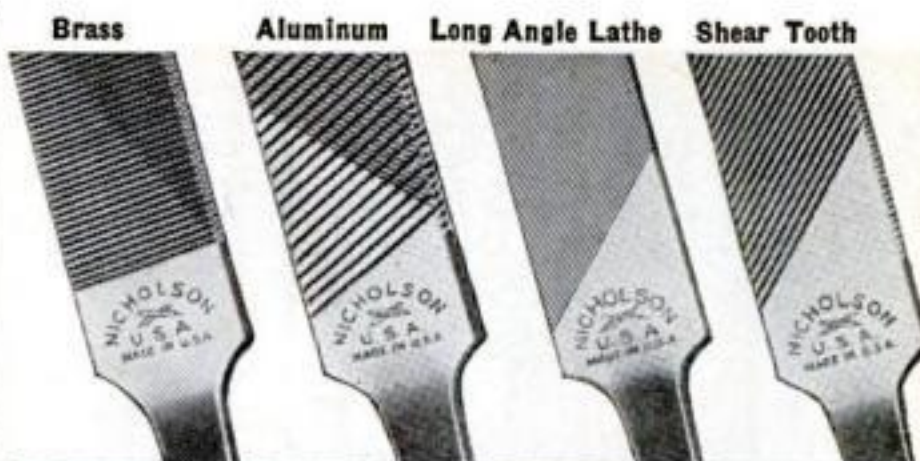
## Short-Focus Lens from Camera Adapted for Use in Enlarger

I WISHED to use the 3" lens from my miniature camera as a projection lens in my 5" by 7" enlarger, but discovered that the bellows would not rack close enough to the negative carrier. An adapter made from discarded film-pack backs solved the problem. Cardboard patterns were cut to obtain the proper size, and allowance was made for folding over on the edges. A lens flange was purchased from a camera supply house and soldered in place. The possibility of light leaks around the edges of the adapter where it fastens to the lens board was eliminated by the application of auto-top patching material, which was flowed into the joint. A coat of dull black paint finished the job.

The use of this adapter enables me to project to 12" by 18" from a double-frame 35-mm. negative. No dimensions are given, as these would vary with the focal length of the lens and the shape of the lens board of your enlarger.—BRUCE BORNHOLT.

## Pinholes in Small Negatives Removed by Double Spotting

PINHOLES in small negatives, caused by dust particles, are rather difficult to opaque and often necessitate considerable spotting on the enlargements. After placing the paper in the enlarging easel, drop the red filter safe light in position and turn on the current so that the pinhole spots are visible. Carefully apply soft lead pencil to these spots. Remove the filter safe light, make the exposure, and develop in the usual way. The lead penciling may be rubbed from the print while it is in the hypo or erased after the print is dry. The spots will appear white and can be eliminated by careful spotting. This is much easier than trying to remove black dots with opaque retouching paint or an etching knife.



which  
would  
you  
use?

THE vast differences in file-tooth construction, as indicated by the four files above, show the importance of selecting *the right file for the job*. Example: For the brass-filing job pictured here, the specially designed Nicholson *Brass* file is being used . . . because its short-angle upcut teeth prevent the file running off the work and keep the file clear of chips, while the long-angle overcut breaks up the filings.

Nicholson makes a file for every purpose—from the tiniest jewelers' to the largest foundry file . . . from general-purpose to special Nicholson or Black Diamond files for working on various metals and other materials toward variously desired results. Consult your hardware dealer or mill-supply house about the files you need.

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WHEN you build a ship model, full-size blueprints are of inestimable help. You can take dimensions right off the drawings and compare the completed parts directly with them in respect to size and shape. Plans are available for about fifty different models.

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New Bedford Whaleboat, with complete equipment, 14" long, 326-R.....	.50
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Trading Schooner, 17 1/2" hull, 252-253.....	.50
U. S. Battleship TEXAS, 3' hull, 197-198-199-200..	1.00



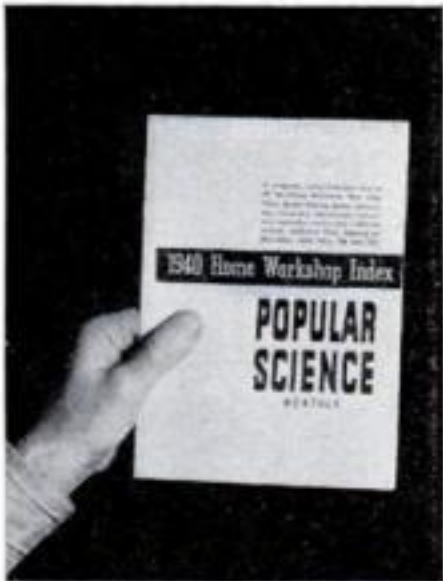
### BOATS

Cabin Cruiser, 17' long, weighs 750 lb., for use with outboard or inboard drive, 356-357-358-359-R.....	1.50
Folding Duck Boat, 13' long, 170-R....	.50
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p., can also be rowed, 344-345-R.....	.75
High-Speed Boat for Small Outboard Motors, 7' 11" long, 257-R.....	.50
Motorboat-Rowboat, 13' long, with decked hull, for use with outboard or inboard drives, 147-R.....	.50
Plywood Dinghy, 9' 7" long, weighs 60 to 75 lb.; can be rowed, sailed, or used with small outboard motor, 387-388-R.....	.75

(Continued on page 213)



New Index Lists Every Article  
of Interest to Home Craftsmen



APPROXIMATELY 900 pages of POPULAR SCIENCE were devoted to home, workshop, and other service material during 1940, and the 1940 Home Workshop Index lists every item. Whether you wish to locate plans for a desk or read what Gus and Joe did to

put out an auto fire, you'll find the Index an instant aid in finding the article. Just send ten cents and a long, legal-size (No. 10) self-addressed envelope to Popular Science Home Workshop Index, 353 Fourth Avenue, New York.

Plans for the Workshop

(Continued from page 212)

Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R.....	1.00
Sectional Rowboat, 9' 8" long; can be used with small outboard, 340-341-R.....	.75
Sport Runabout, 9' 8" long, for small outboard motor, weighs 100 lb., 309-310-R.....	.75
Utility Rowboat, 13' long; can also be sailed or driven by outboard motor, 224-R.....	.50



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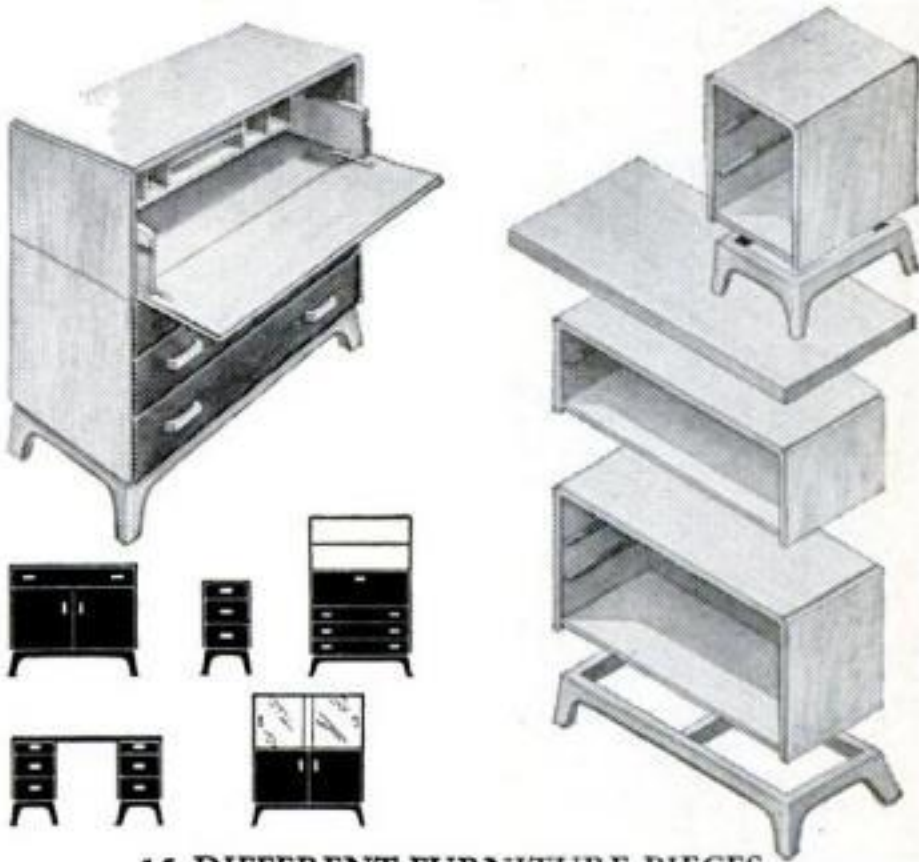
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BECAUSE of the tremendous interest in models of war vessels at the present time, POPULAR SCIENCE has just added a submarine chaser to the list of construction kits available. The prototype of the model pictured above cruised from New London, Conn., to Bermuda, the Azores, Portugal, and France; and operated from Plymouth, England, to attack many U-boats during the first World War.

The model is 20 3/8" long, and was scaled 3/16" to 1' from official U. S. Navy plans. The kit contains a precision-shaped hull, raw materials for deck and spars, and all the finished fittings, such as propellers, ventilators, guns, ladder, blocks, bell, stanchions, and the like. Kit 12S, \$7.00†.



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(Continued on page 216)



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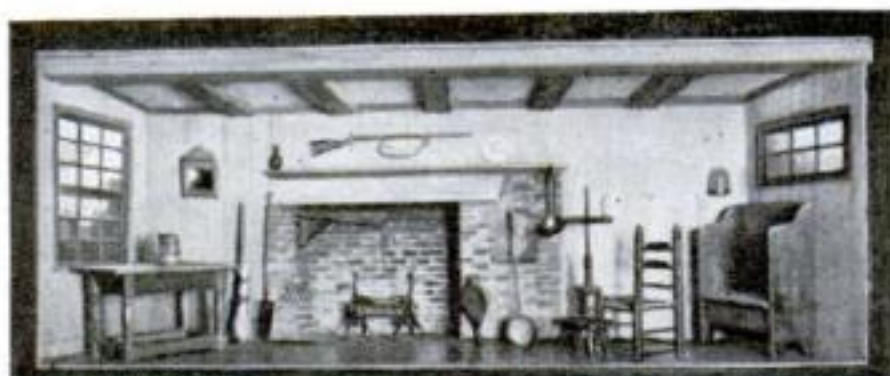
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**KUMFY PRODUCTS CO.** Dept. M-205 Cincinnati, O.

## Kits Make Fine Gifts

(Continued from page 214)



and 5" deep. See P.S.M., Nov. '40, p. 206, for a complete description. Kit 13, \$2.00.

**EARLY COLONIAL TAPROOM.** So great was the interest of our readers in the Colonial Kitchen that POPULAR SCIENCE now offers an Early American taproom. Designed to a scale of 1" equals 1', the new model depicts a typical tavern scene. All the activities that today are divided among hotel lobby, lounge, writing room, bar, and dining room went on in this single low-studded room. Here the gossip of the countryside was told and retold; the old room furnished the setting for political, civic, and military conferences.

The kit contains walls, ceiling, floor, fireplace, and clock printed in four colors on



heavy cardboard; thin wood from which can be jig-sawed the flat pieces for the table, bench, and chairs; turned chair rungs and uprights; finished metal andirons, tongs, sconces, jug, lamps, and tankards; dowels, wax, glue, and pins. Kit 14, \$2.00.

**SOLID MAHOGANY BOOK TROUGH.** Any member of your family or a friend would appreciate receiving a beautiful book trough. It is 22½" long, 9½" wide, and 24¾" high. The kit contains all the necessary wood ready to assemble, and finishes. Kit 4, \$5.30\*.

**"HOBO HANK" WHITTTLING KIT.** Anyone who enjoys carving things with a pocketknife will like this kit. It contains a

(Continued on page 218)



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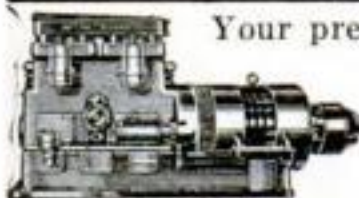
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**Kits Make Fine Gifts**

*(Continued from page 216)*



master model of "Hobo Hank" so that all one has to do is to copy the model cut by cut on the stenciled pine block. The figure is 5 3/4" tall. Kit 10, \$1.50.

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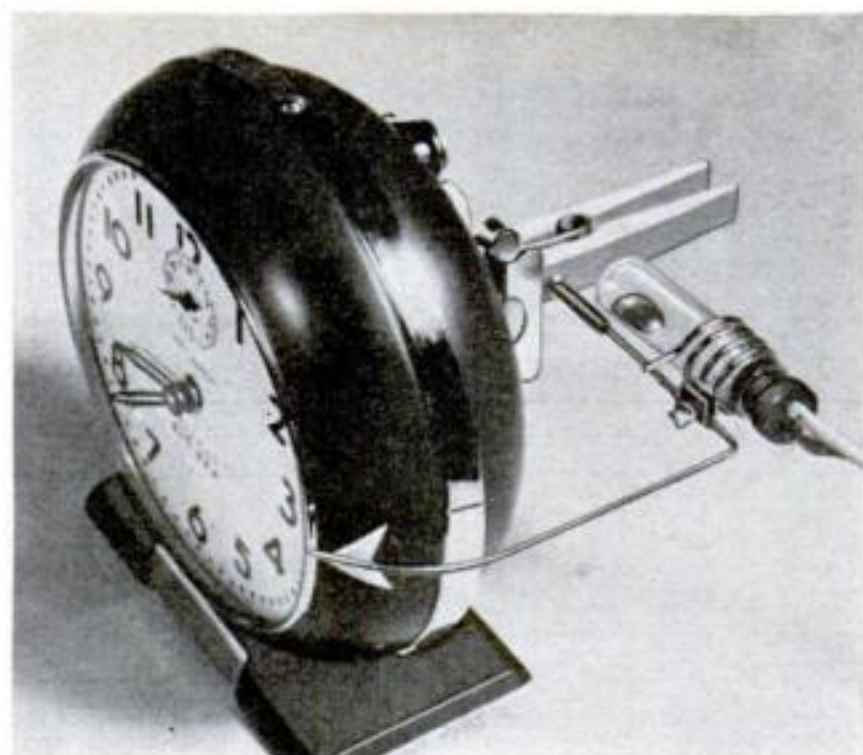
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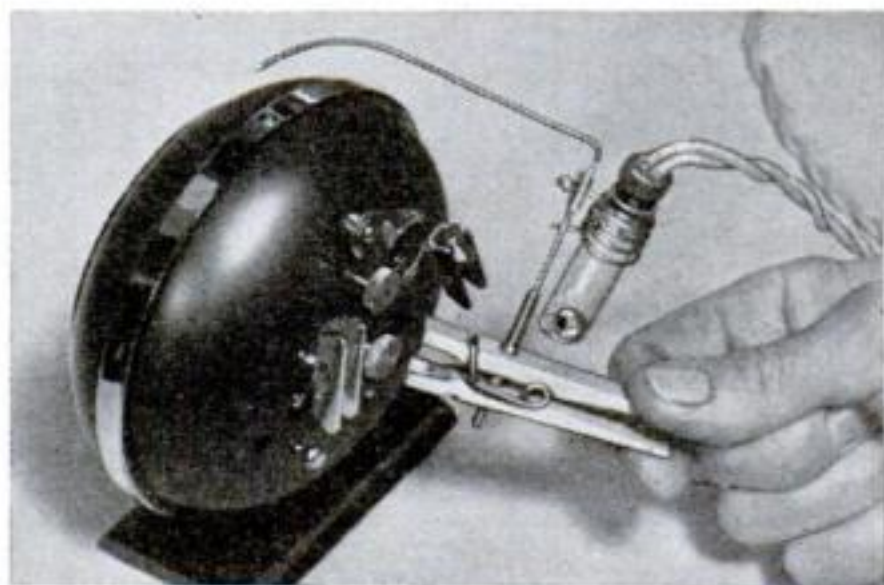
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## Mercury Switch Controls Alarm on Darkroom Timer

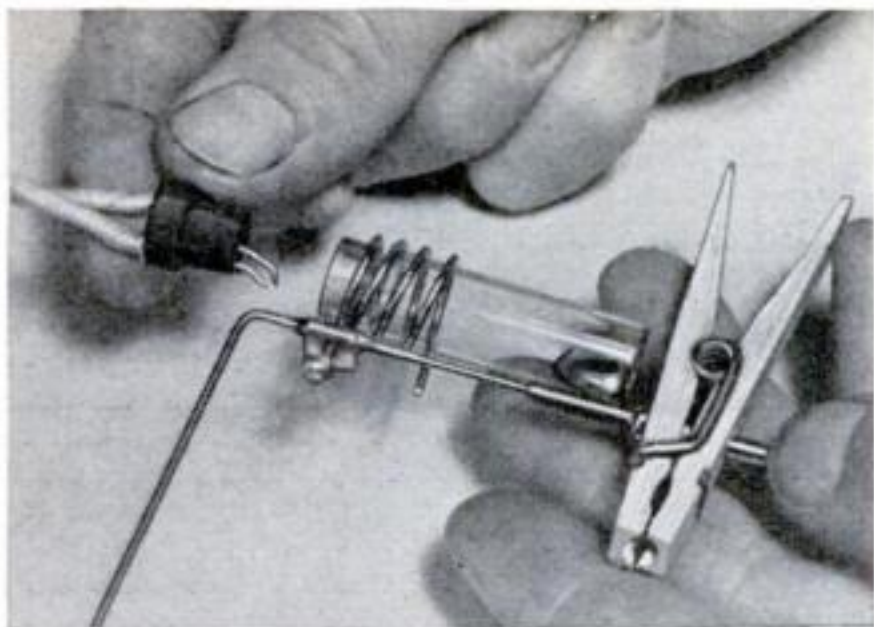
THIS darkroom timer consists of an inexpensive alarm clock and an improvised mercury switch. Cut off  $\frac{1}{4}$ " from the jaws of a spring-type clothespin and round the inside of the jaws to fit the knurled knob by which the hands of the clock are turned. Take a bicycle spoke and turn on one nipple to leave enough of the threaded end to slip through a hole drilled in one side of the clothespin; then screw on a second nipple. A hole should be drilled in the other side of the clothespin large enough to slip freely over this nipple. The opposite end of the spoke is bent to form the indicator arm. An arrow is soldered on as illustrated.

Now coil a piece of spoke to hold a small vial as shown. The top coil is pinched smaller to hold the neck of the vial, and the end of the wire is bent to form an axle for the vial to swing on. Run this end of the wire through a small shackle bent from brass and soldered to the indicator arm. A drop of solder on [\(Continued on page 221\)](#)



The mercury-switch assembly clips on the knurled knob of the clock and turns with the clock hands





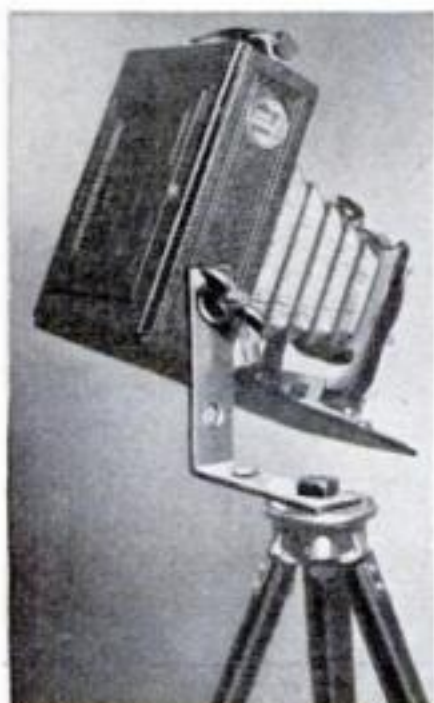
How the switch is assembled. The contact wires pass through the cork, which is inserted in the vial

the end of the coil wire keeps it in place. The bottom of the coil wire is bent at the same angle as the top wire, forming a stop which tips the vial as the assembly is moved around.

Some mercury is placed in the vial, which is fitted with a rubber cork. Wires that form the contact points are inserted through the stopper and bent as indicated. The stopper is inserted so that the points are on the underside of the vial as it tilts. Very flexible wires are soldered to the projecting ends of the contact wires and connected to the house doorbell circuit or a separate circuit. The bell will ring when the arrow reaches the position shown in the photograph at the beginning of this article, so all that is necessary is to clip the assembly to the knurled knob with the indicator arm set back the number of minutes desired.

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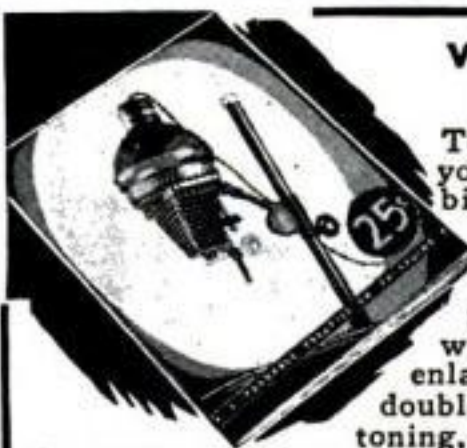
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**Popular Science Monthly—Dept. 11**  
**353-4th Ave. New York, N. Y.**

**Printed Matter Split in Two**  
**to Preserve Both Sides**

PHOTOGRAPHERS sometimes wish to make a contact print of a picture or printed matter, but cannot do so because there is printing on the other side of the sheet. One solution is to split the paper in two. This is not at all difficult. Paste a piece of cloth or very strong paper to each side of the sheet to be split. When dry, pull the two pieces asunder violently and without hesitation. Part of the sheet will be found to have adhered to one, and part to the other. Soften the paste in water, and the pieces can be easily removed from the cloth.

The process can be used in various ways. If it is desired to paste in a scrapbook a newspaper article printed on both sides and there is only one copy, it is convenient to know how to split the paper. The printing will be legible, but somewhat duller than it was originally.—J. C. BRANSTETTER.

**Determining Exhaustion Point**  
**of an Acid Fixing Bath**

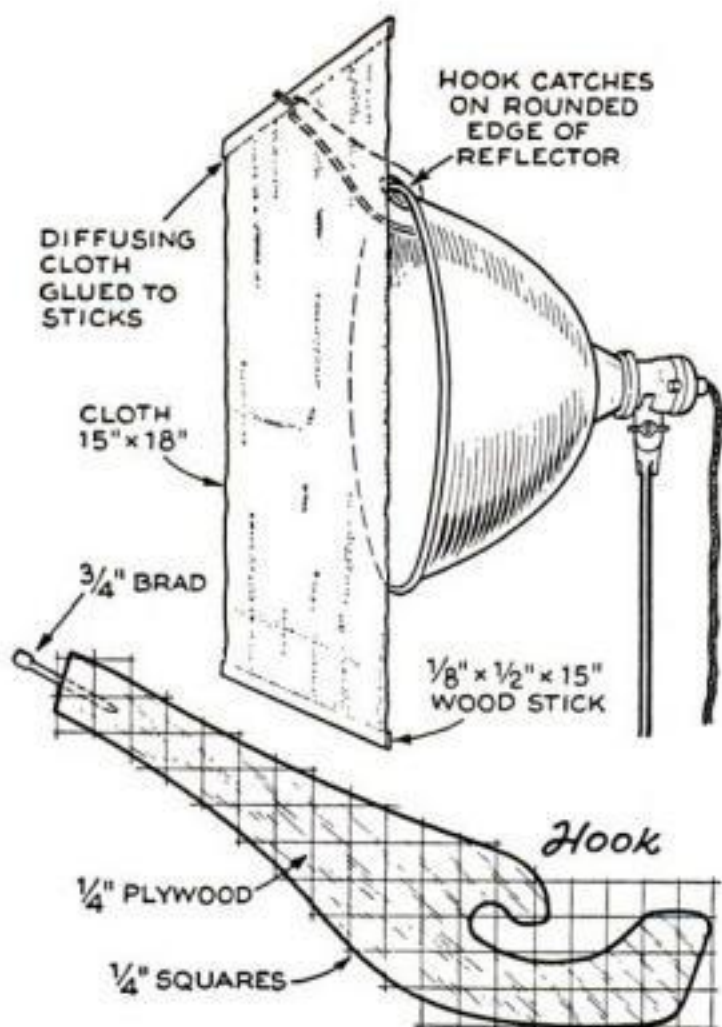
EVERY photographer realizes the value of using fresh hypo to fix his prints, but he often throws away the solution when it is still good. A quart of acid fixing bath is suitable for 2,000 sq. in. of print surface if care is taken to dip the prints in a stop bath before transferring them to the fixing bath. This means that 273 prints of the 2¼" by 3¼" size may be safely fixed before throwing out the solution. Approximate figures for other sizes follow: 2½" by 4¼", 188; 3¼" by 4¼", 144; 3¼" by 5½", 111; 4" by 5", 100; 5" by 7", 57; 8" by 10", 25.

Keep the bath on the acid side by adding a few drops of pure acetic acid occasionally. You can use blue litmus paper to test for acidity—it should turn red. Keep the temperature of the solution at about 70 deg. F., because sulphur is precipitated at higher temperatures. This causes yellow stains to appear later.—J. H. W.

**Lacquer Protects Movie Film**

APPLIED to one or both sides of 35- or 16-mm. movie film, a new lacquer effectively protects them from scratches. The coating, rather than the film itself, receives the surface wear. When this has gone far enough to affect projection, the lacquer, according to the manufacturer, can be removed and a new coating applied, making the film as good as new.



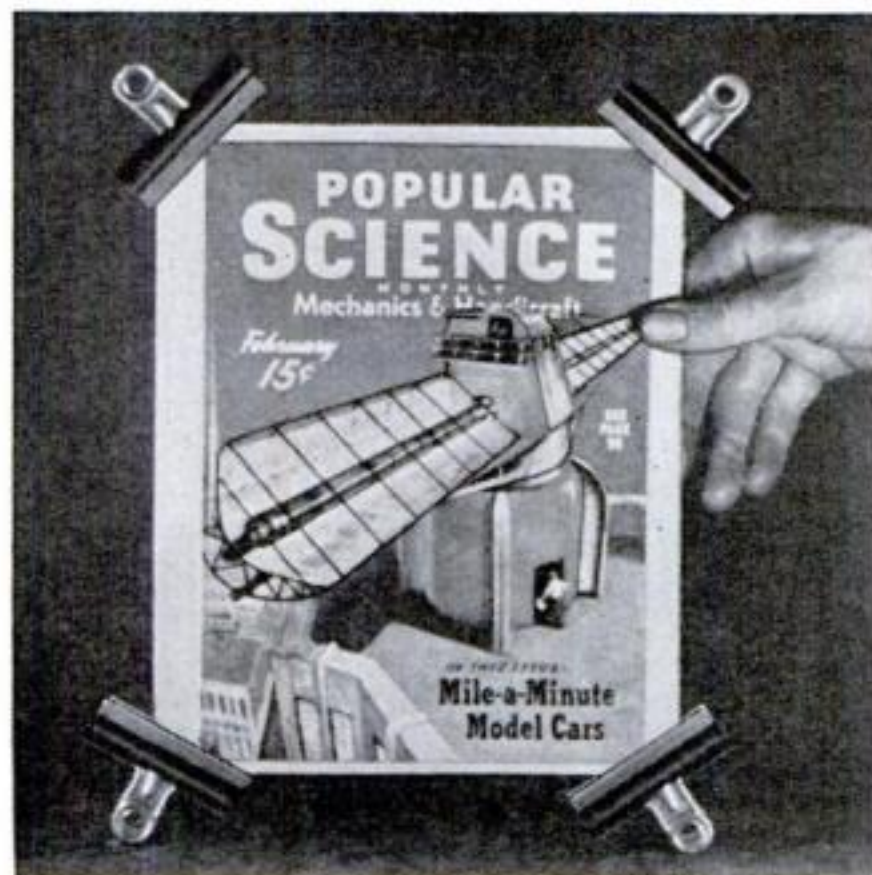


## Plywood Hook Holds Diffuser in Front of Photoflood Lamp

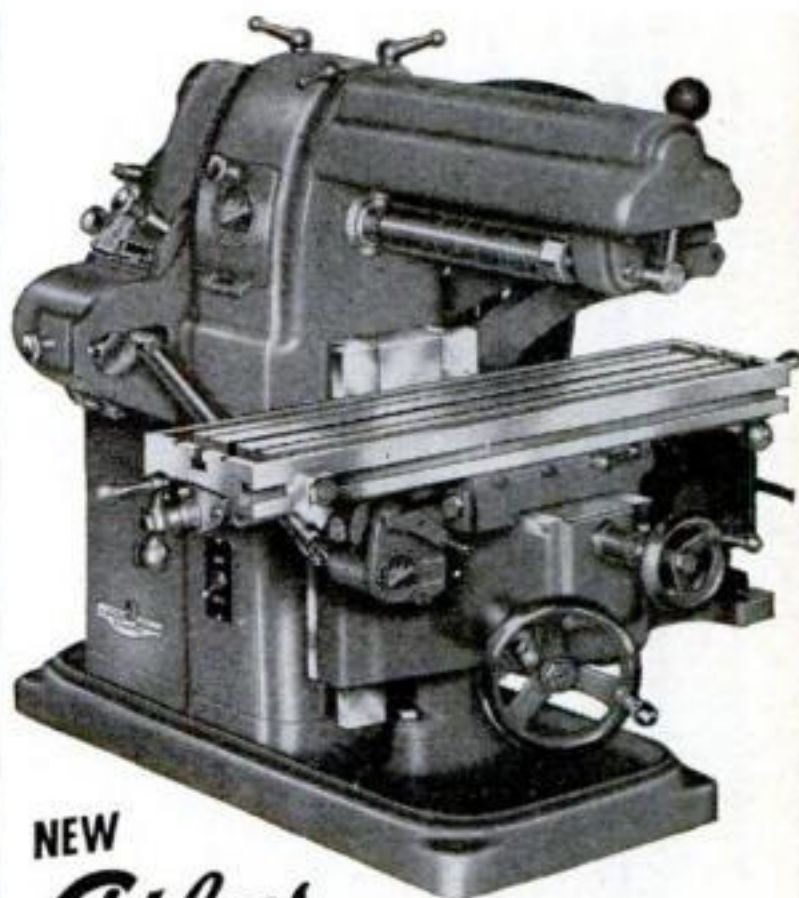
A DIFFUSING cloth can be hung in front of a photoflood lamp by means of a single hooklike bracket jig-sawed as shown from  $\frac{1}{4}$ " plywood. It hooks on the reflector rim and holds the cloth far enough out so that it will not be scorched.—JOSEPH WILLIAMS.

## Flattening Work for Copying

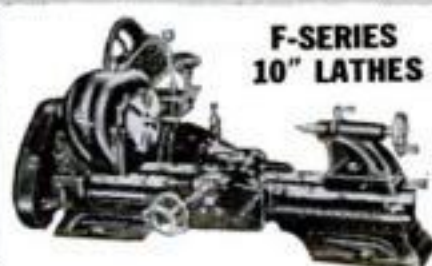
TO HOLD an original picture or document flat when copying with the camera, cut a piece of corrugated board a little larger than the copy and use a spring paper clip on each corner as shown.—J. H. DUNNEWIN.



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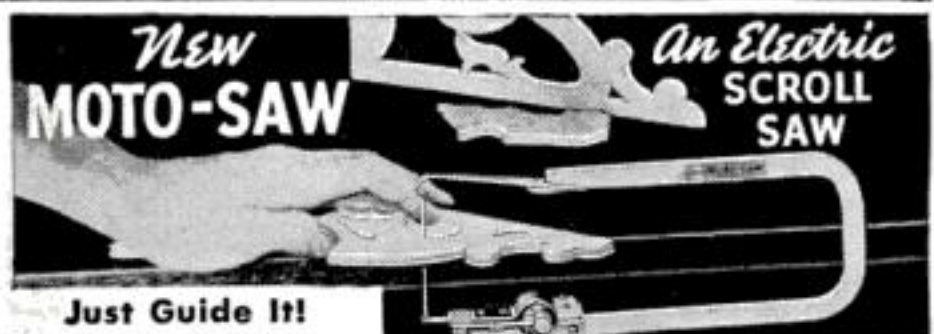
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## Gus Tackles a Tough One

(Continued from page 142)

You never know what you'll find. Let's go!"

They disconnected the clutch pedal, and methodically went about removing the clutch. All of its working parts seemed to be in perfect condition. The thrust ring fitted snugly. There were no projecting rivets. The clutch shaft was in alignment, and so were the bearing seat on the clutch sleeve and the throw-out yoke.

Gus said something under his breath. Harry laughed. "It sure does me good to see you stumped," he said mockingly.

"Go right ahead and enjoy it!" Gus told him. "There's something screwy about this job. Well, there's no sense in wasting more time on the clutch. It's all right."

They put back the clutch and replaced its cover. Then they started to reinstall the transmission—but for some reason it didn't slip smoothly into place.

"Now what?" Gus grumbled. "Hey, look at this!" He pointed at one of the hangers, which also acted as a rear engine support. It was badly bent. "There's the cause of that darned noise!"

Harry examined the support. Then he did some thinking. "I don't get you," he confessed at last. "The hanger's bent, of course, but what—"

"The front end of this car has been wrecked," Gus said, "and that darned Magruder didn't have sense enough to tell me about it. Look—this cross member is bent, too, on the same side. Whoever botched up the repair job forced the bent hanger into place on the bent cross member. That cocked the engine a little, and cocking the engine took most of the road play out of the drive shaft. Putting the brakes on hard caused the engine to move a little on its rubber mountings. That further decreased the amount of play and caused that grinding noise. I *knew* there was something screwy about this job!"

"Well, what'll we do now?" Harry asked.

"Go home and go to bed," Gus said. "First thing in the morning we'll straighten that cross member and put in a new hanger to replace that bent one—and that'll be the job! Maybe I won't tell that champion-collecting Magruder something when he calls up! He'll find our time on his bill, but I might have gone to a movie tonight."

"You might have," Harry agreed. "But you know darned well that you enjoyed this a lot more than you would have a movie."

Gus grinned. "Sure I did," he said. "I like a sweat-and-cuss job once in a while—they get you up on your toes!"

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## Plastics in the War

(Continued from page 84)

the Channel on night raids, the gunners who man the machine-gun turrets at the tail sit enclosed by transparent plastic windows and surrounded by plastic aids. Even the vital ammunition conveyors, carrying cartridge belts to the machine guns, are now produced from synthetic resins. According to advices from abroad, aircraft manufacturers in England recently conducted a survey, listing every possibility for replacing metal with materials created in the laboratory. In each new design, plastics play a greater part.

At the De Havilland plant, near Hatford, England, a steam press capable of exerting a giant's grip of more than 4,000,000 pounds pressure is turning out laminated spruce-and-Bakelite blocks for the manufacture of propellers. Another wood-and-plastic product, known as Jabroc, supplies the material for producing dies used in the fabrication of sheet steel and aluminum alloys. Such dies will endure more than 2,000 pressings without losing their shape. In the aircraft industry, where changes in design are frequent, the ease with which such plastic dies can be made is of great importance. Bearings and gears, produced from textile-mill waste material impregnated with synthetic resins, are reported in wide use in wartime German factories. A feature of such plastic gears is the fact that they are self-lubricating.

A few weeks ago, in a New York City laboratory, an American inventor demonstrated a new type of leakproof fuel tank for fighting planes. Firing pointblank, he sent .45 caliber bullets crashing through the gasoline container. Each hole was sealed promptly by the swelling action of a latex-and-plastic layer which lines the walls.

Of all the widespread wartime applications of synthetic resins, the one with the most dramatic possibilities is the present concentrated effort to produce plastic planes. The vision of streamlined fighting ships pouring from the production line has caught the popular imagination. In many parts of the world, engineers are tackling the problem in deadly earnest. Recently the Glenn L. Martin Company, one of America's largest producers of bombers, established a fellowship for plastic-plane research at the Mellon Institute, in Pittsburgh, Pa. Howard Hughes, famous round-the-world record holder, is reported to be building an experimental bomber of plastics in his Los Angeles factory. The Timm trainer,

(Continued on page 226)

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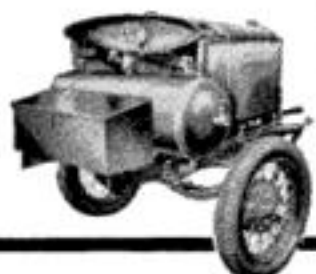
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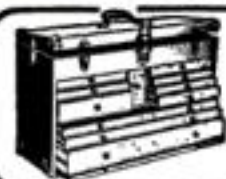


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## Plastics in the War

(Continued from page 225)

another California product, has already flown. Eugene Vidal's Summit monoplane is nearing tests at the Bendix Airport, in New Jersey.

Vidal and Col. V. E. Clark, two American pioneers in the plastic-plane field, are both men of wide aeronautical experience. Vidal, up to 1937, was Director of Air Commerce, in Washington, D. C., and Clark was in charge of the aircraft-procurement division of the Army during the first World War. Each has his own ideas of manufacture, but the basis is essentially the same.

Strips of plywood are treated with a thermosetting plastic, that is, a synthetic resin which, like Bakelite, softens when heat is first applied and then hardens into an insoluble and infusible mass with continued heating. The strips are then placed on a mold, and mold and plywood are slipped into a heavy rubberized bag. Inside a steam chamber, the pressure of the steam forces the bag against the plywood, while the heat softens and then hardens the plastic. The bag applies pressure equally on all parts of a curved surface, a thing virtually impossible to accomplish with a hydraulic press. Thus, in a single operation, a whole wing or fuselage can be turned out.

Such airplanes, "made in rubber bags," have many advantages. They are not affected by weather, funguses, oil, water, or gasoline. They are free from internal strains. Because they have fewer parts, they are easier to repair. Another important feature of their design is the fact that the wing and fuselage surfaces are as smooth as glass. It takes more than forty horsepower just to pull the rivet heads on a modern all-metal skyliner through the air. Plastic construction would save power and increase speeds. Bombers could fly faster and training planes could be powered with smaller, more economical engines.

While mass production of such machines lies in the future, many authorities believe that the development of plastic planes will constitute one of the major advances of this war in which synthetic resins play such varied roles.

## Bones Broken by Exertion

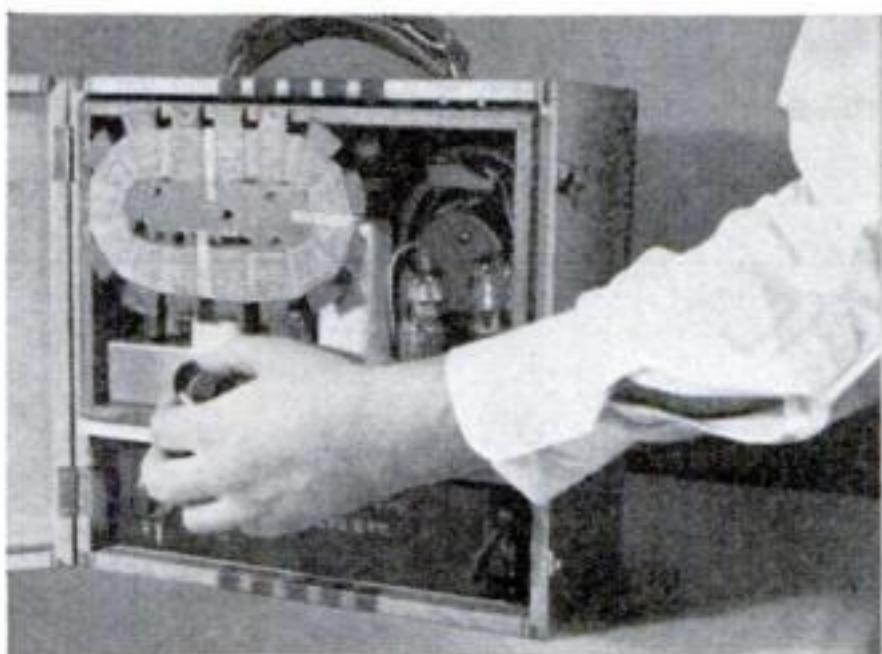
It is possible to break a bone by violent muscular exertion, according to Dr. Frank P. Strickler, of Louisville, Ky., who recently reported six cases of the kind in his own experience. However, Dr. Strickler adds, such accidents are extremely rare.

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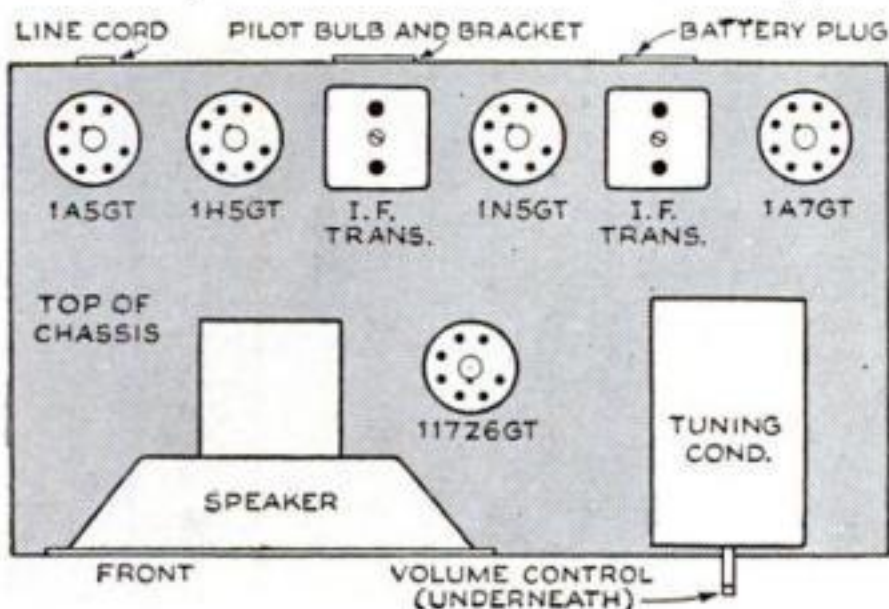


# Summer-Winter Radio

(Continued from page 193)



For outdoor use, the table model rests on a shelf in the larger cabinet. Below it is the battery pack



This top-chassis view shows how tubes are arranged feeds into a five-inch permanent-magnet speaker through a universal output transformer. As the reader follows the circuit diagram, he will see a fifth tube—the 117Z6GT—which serves as a rectifier, when the set is using A.C. house current, to supply the necessary direct current. The "A" current flows through a 2,500-ohm, 10-watt resistor and a 60-milliamper pilot bulb, which serves as a fuse to protect the filaments of the tubes, and does not light when the batteries are in use. Plate current is supplied through a 3,500-ohm, 1-watt resistor and two electrolytic condensers of 24 and 40 microfarads, respectively, and 150 volts each.

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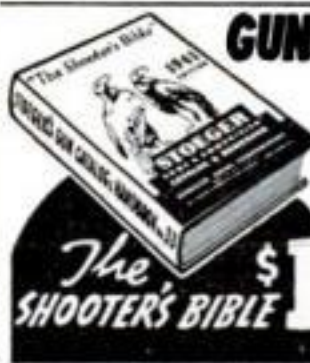
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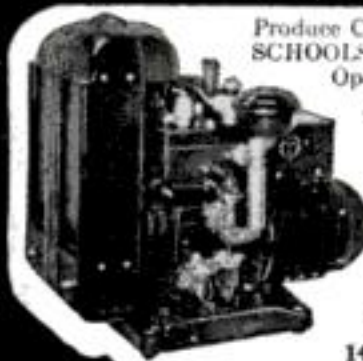
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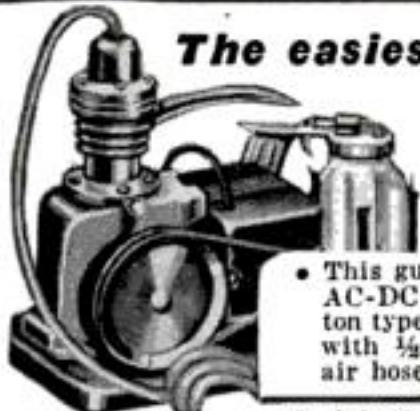
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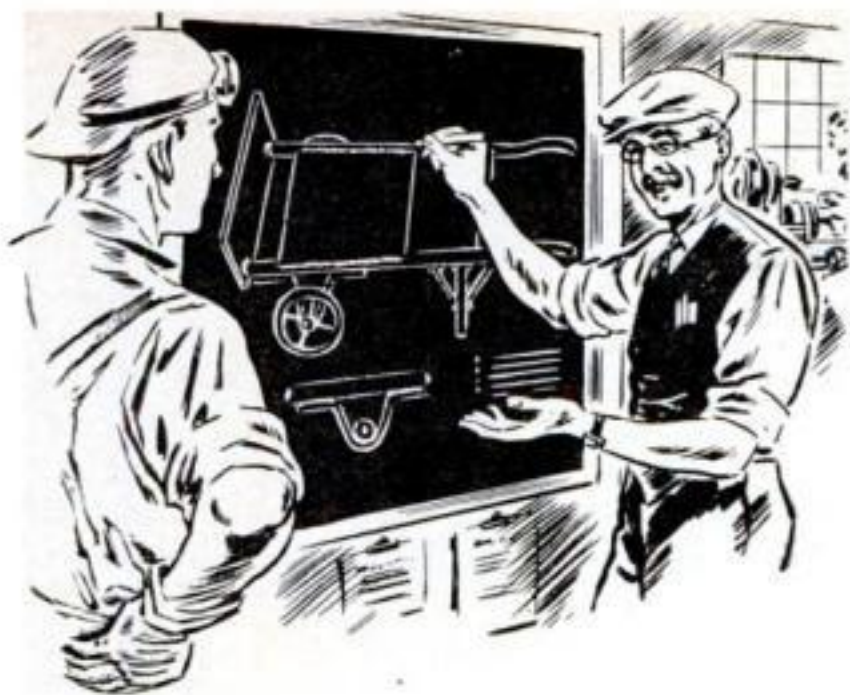
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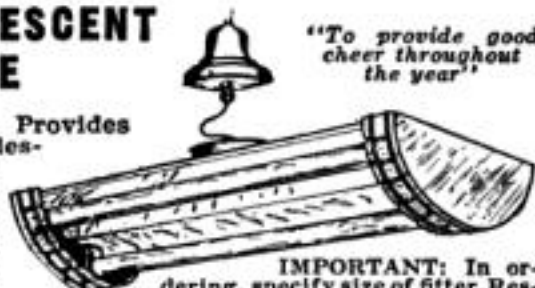
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## Locating Electrical Trouble in a Toy-Train Transformer

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If the transformer hums but no current is obtained from the terminals, the fault will be found in one of the low-tension wires leading to the various binding posts or the speed-control switch.

A transformer that has been continuously short-circuited will burn out. This condition can be detected by a burnt smell, and charred wiring inside. There is no way of repairing a burned-out unit except to rewind the coils, and in nearly every case this is not worth while.—H.V.L.

## Printer's Brass Rule Makes Accurate Straightedge

HAVING occasion to rule a number of long lines, I tried to buy a straightedge that was straight. I looked at scores of brass-edged rulers 18" long, and the best of them had a bow of over 1/16". The only satisfactory ones I could find were steel straightedges at artists' and draftsmen's supply stores, but these cost several dollars each—more than I wanted to pay.

Finally I went to a printers' supply company and bought a 24" length of one-point brass rule on a two-point base. It is about as straight as one could ask, yet it cost only a few cents. Being on a two-point base, the edge is slightly raised from the paper, which prevents ink smears. If desired, the rule could be cemented to a piece of printer's "reglet"—a wooden strip less than type high—which will raise the edge about 1/8" off the paper. The strip protects the rule and makes it easier to handle.—LEE UNDERHILL.

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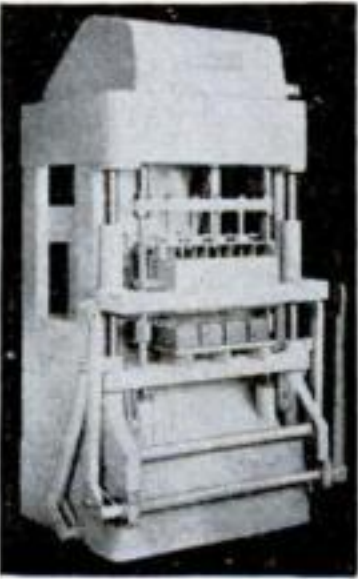
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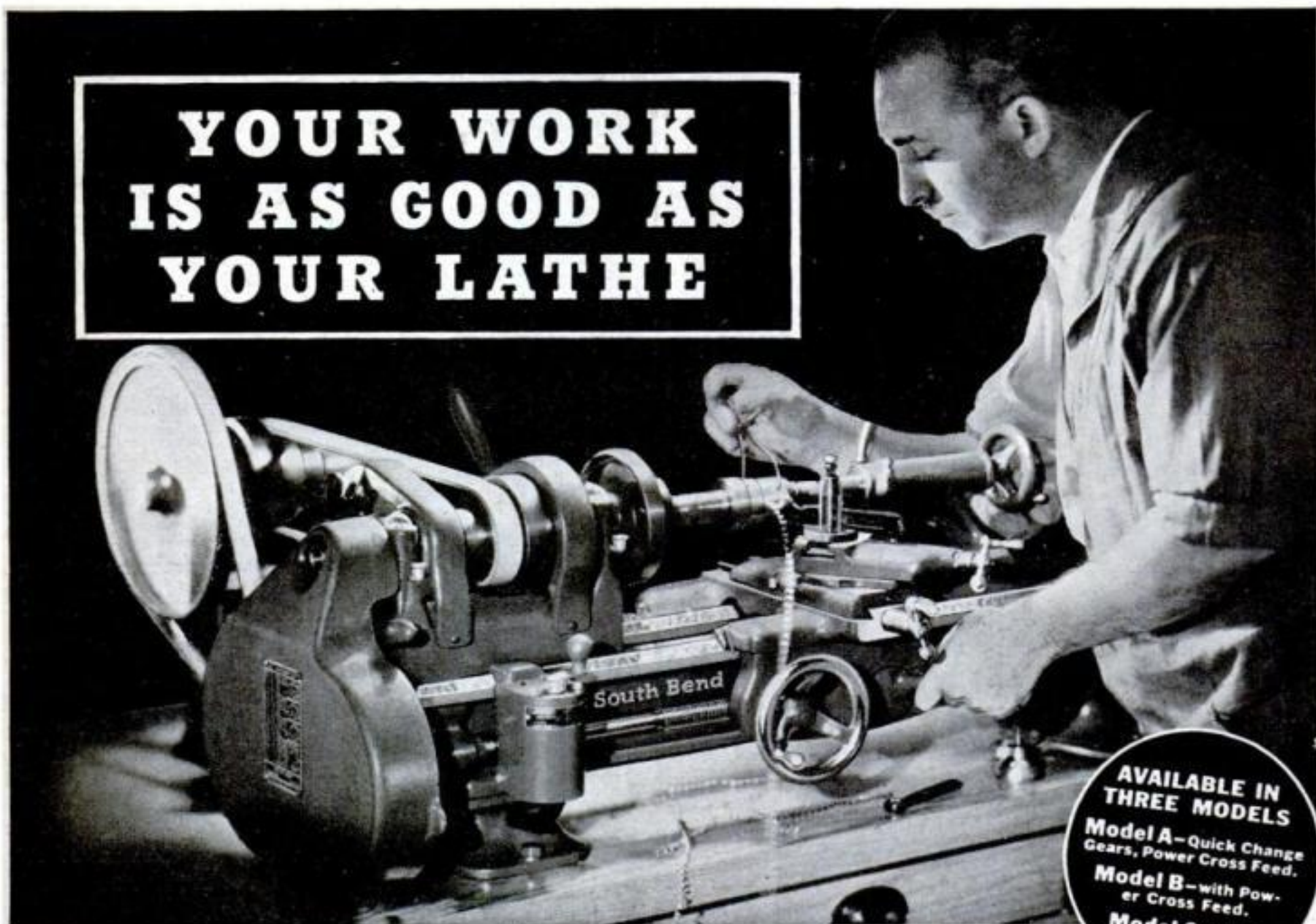
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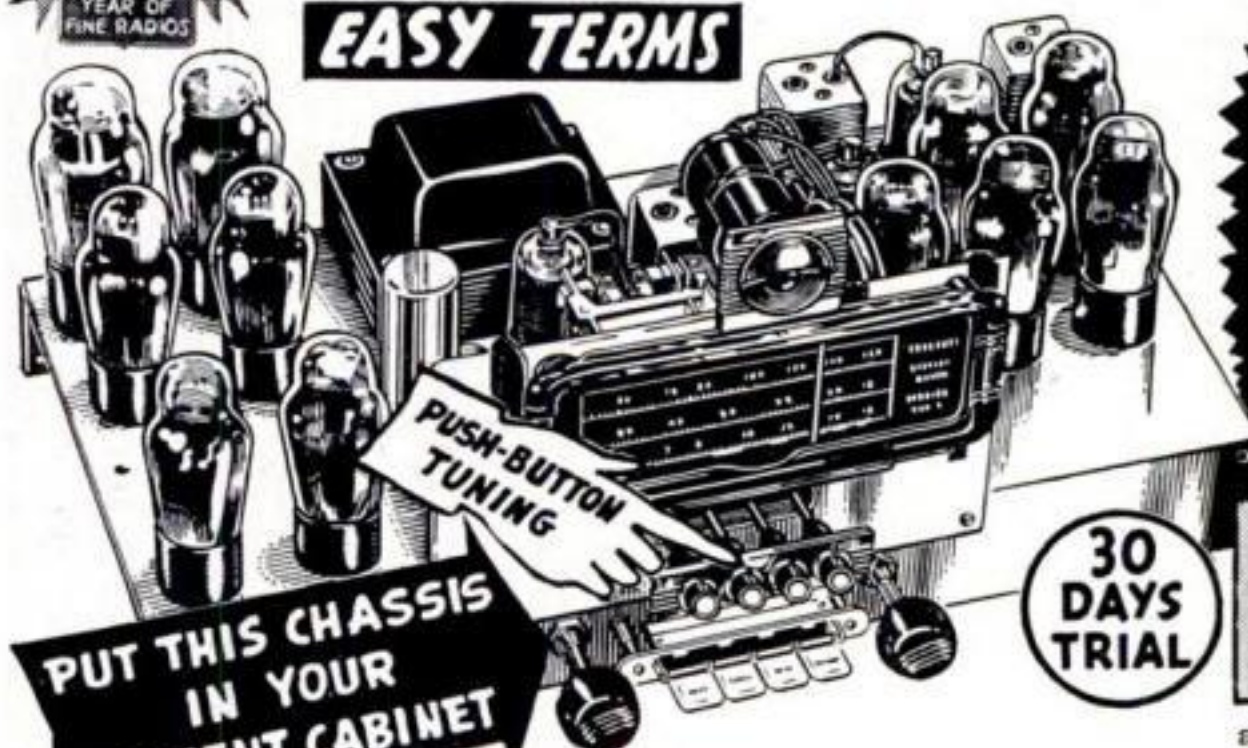
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